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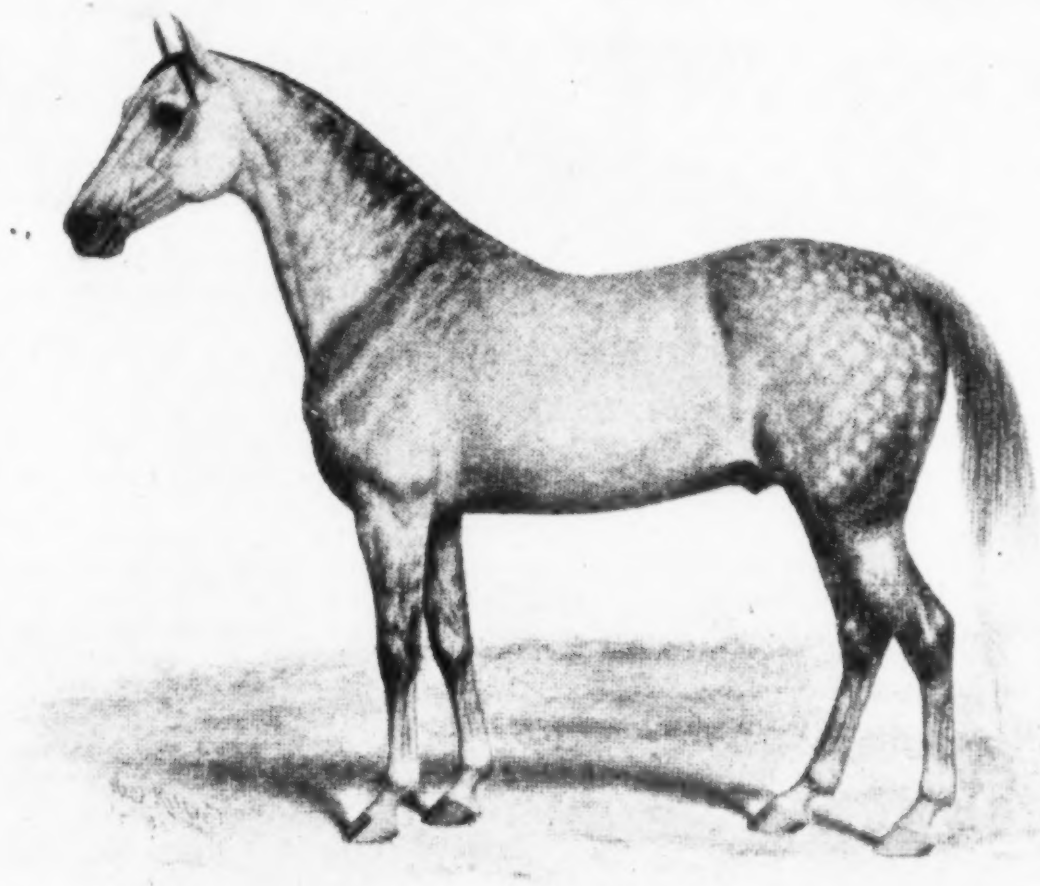

LINDEN TREE—A FAMOUS ARAB STALLION

(See Page 354)

Endurance Rides of the Pony Express
Thornton Chard

Breeding Smooth Awned Barleys
H. K. Hayes

William Edwin Safford
An Appreciation

Color Inheritance in Four O'Clocks
Kiernan and White

OCTOBER, 1926 Vol. 17, No. 10

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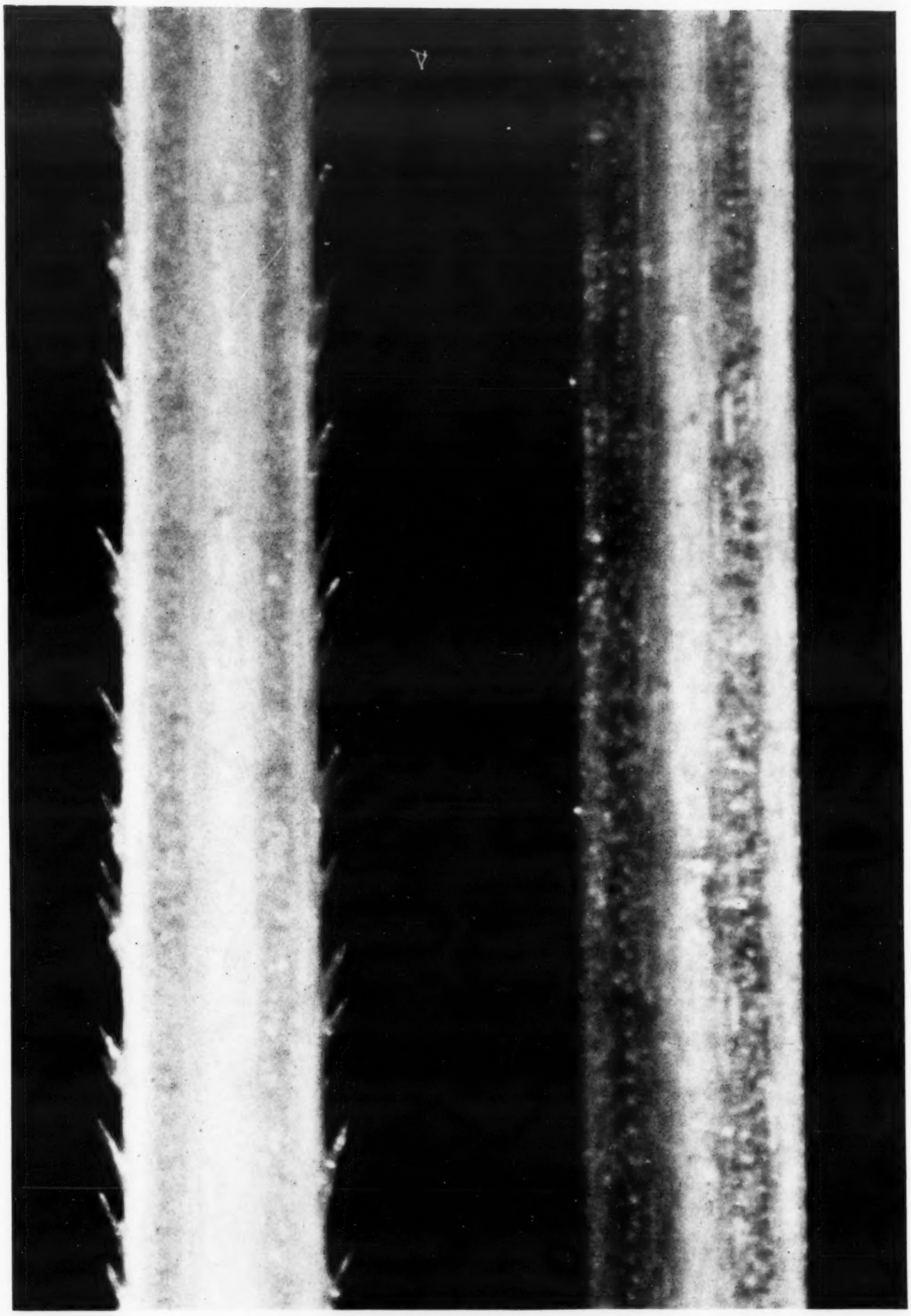


BREEDING THE BARBS OFF BARLEY AWNS

Frontispiece

This shows how barley awns look when they are magnified thirty times. It also makes clear why the rough awned varieties are so unpleasant to work with. The mature awns are extremely fragile and break into small pieces. During the harvest these fragments work into the clothing and the barbs on the rough awns cause great discomfort. They are even dangerous, as such pieces in the eye or throat are extremely difficult to remove, sometimes requiring a surgical operation. Unfortunately the smooth awned varieties heretofore available have had other less desirable characteristics. The value of smooth awned varieties as good in other respects as the rough awned barleys has long been recognized, but breeding off the barbs has not been easy. Experiments extending over fifteen years were necessary before success was achieved, by the direct application of Mendelian principles. See "Breeding Smooth-Awned Barleys," page 371. Photograph by E. L. Crandall and Robert Cook.

ENDURANCE RIDES OF THE EARLY '60'S

THORNTON CHARD

Did ever you hear of the Pony Express?
(Carried the mail on the plains, you know)
Never such riding as theirs, I guess,
On burning desert or field of snow.

Two thousand miles as the crow might go,
That was the journey the riders went
On the Utah trail from old St. Joe
To the sunset side of the continent.

S. H. M. Byers.[7]*

THE test of endurance in both horses and riders of the famous Pony Express of sixty-five years ago, makes fascinating reading for the horsemen of today, when no such gruelling and dangerous exploits are required or attempted. And one wonders why, along with the detailed records of the pony boys, so little exact information is given about the breeding and character of the horses that made possible the remarkable rides. Probably in those days in the West, hardy horses were taken as a matter of course, because they had to be hardy to be of any use, much in the same sense that the Arab's life depended on the speed and endurance of his mare.

However, there are a number of general references about the Pony Express horses, like the following: "These horses were generally half-breed *California mustangs* . . . . . and were as sure-footed and fleet as a mountain goat." [13-169,20-28] "The animals that (some pony boys) . . . used to ride, were the worst imps of Satan in the business. . . . . But travel! They never seemed to get tired. I knew John Frye (express rider) to ride one of them fifty miles without change."[20-36] "The stations were from ten to fourteen miles apart and a fresh horse, *Spanish blood*, was obtained at each station."[20-39] "While always called the Pony Express, there were many blooded† horses as well as ponies in the service."[4-23]

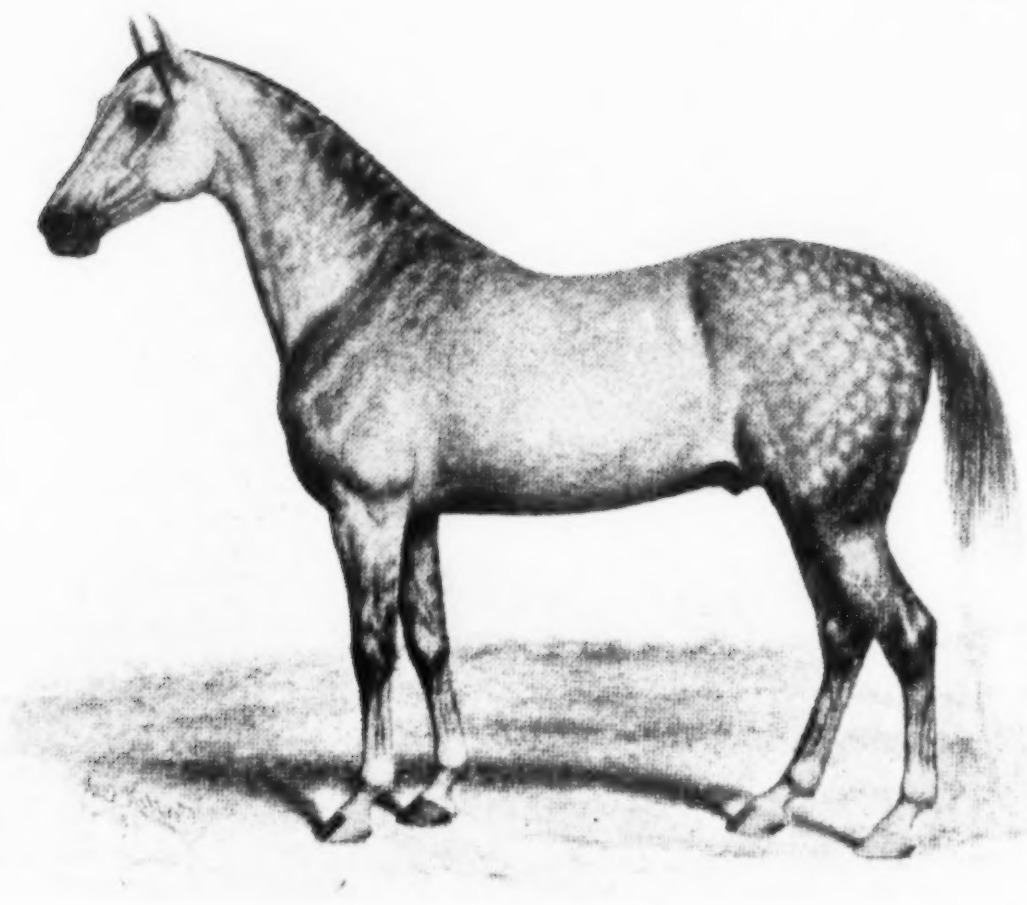
"Horses were purchased throughout the West. They were the best that money could buy and ranged from tough California Cayuses or Mustangs‡ to thoroughbred stock from Iowa. They were bought at an average figure of $200 each, a high price in those days."[4-25] "That only one rider was ever taken by the savages, was due to the fact that the pony-men rode magnificent horses which invariably outclassed the Indian ponies in speed and endurance."[4-55] "He (the rider) was to depend wholly on speed for safety" . . . . . "While the horses were of the highest grade, they were of mixed breed§ . . . . . good results were obtained from blooded animals from the

*Numbered references are to "Literature Cited" at end of article. The number following the hyphen in the reference indicates the page cited.

†This is undoubtedly a reference to thoroughbred blood.—T. C.

‡Strictly speaking Cayuse is the Indian name for the Indian pony of the breed (?) formerly in use among the Cayuse Indians of the Northern Rocky Mountains; Bronco is the name of an unbroken or imperfectly broken horse, usually a mustang or Indian pony; and Mustang is the name of the descendants of the stock of Spanish importation reverted to the feral state (Century Dict.) Although all three terms refer to horses of Spanish origin, in some of the quotations in this article the terms have been used loosely.—T. C.

§From what follows, it seems that the author intends to say various breeds.—T. C.



PURE-BRED ARAB SIRE

Figure 1

Leopard, a pure Seglawi-Jedran Arab,* was presented to General U. S. Grant by the Sultan of Turkey in 1879.

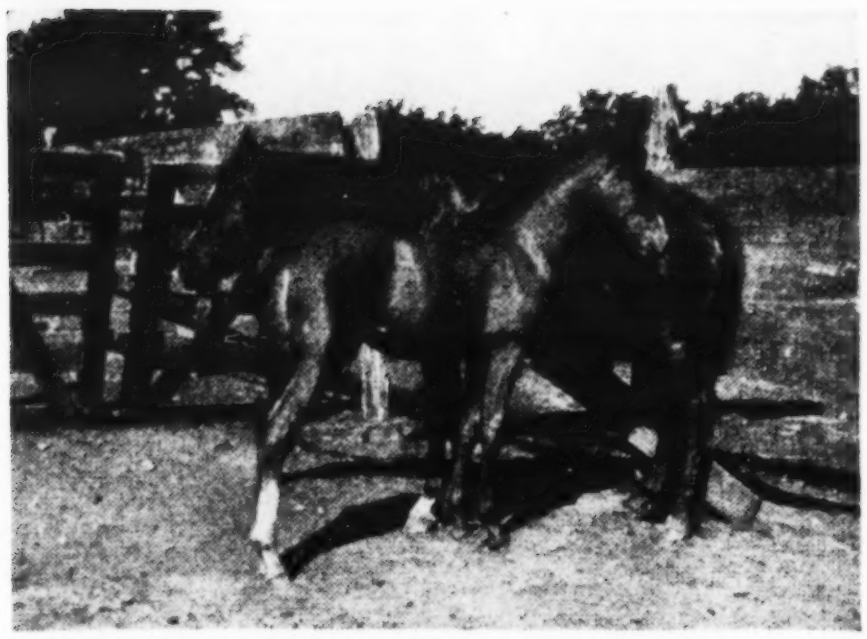
The progenitors of the *Mustang*, undoubtedly, had more Barb than Arab blood and were inferior as to pureness, compared to Leopard; "but no other known blood [arab and barb]* is so intensely positive in its influence even through many removes; and is the only known equine blood upon which can be built or created fixed or reproducing types." Leopard was a great grandsire of *Nimrod* (Figure 4). Copyright by the Century Company, and reproduced here by courtesy of the *Century Magazine*.

*From a letter of the late Randolph Huntington to the writer, June 2, 1903.

Missouri; but considerable preference was shown for the western bred mustangs. These animals were about fourteen hands high and averaged less than 900 pounds* in weight."[4-57] "They were the small, hardy *Mexican* animals, very fleet and particularly safe for mountain travel."[18-112] "The ponies ridden by James (express rider) were *California mustangs*, in their day considered the fleetest of animals in that part of the country (Nevada—*T.C.*)."[18-130] Buffalo Bill says that the Indians "gave me a close call with several bullets, but it fortunately happened that I was mounted on the fleetest horse belonging to the Express Company and one that was possessed of remarkable endurance. Being cut off from retreat back to Horseshoe, I put spurs to my horse and lying flat on his back, kept straight on for Sweetwater, the next station . . . . . having distanced my pursuers. . . . . Upon reaching that place . . . . . I found . . . . . the Indians had . . . . . driven off the horses, so that I was unable to get a remount. I therefore continued on to Ploutz Station—twelve miles farther—thus making 24 miles straight run with one horse."[13-183]

Of the many references consulted, the ones quoted above are the most specific. From them we gather that much value was placed on "*Spanish blood*" (arab and barb); and we know

*The truth would still have been told if the author had said less than 850 lbs.—T. C.



MUSTANG=ARAB COLT

Figure 2

The mare is a pure-bred Mustang, and her colt is by Nimrod (Figure 4). Most of the Pony Express mounts were Mustangs. Some of them probably as hardy as this mare which is believed to be "Fanny" well known on the Texas-Mexican border about 1900; and such a stayer or "longhorse" that she was coveted by the Mexican bandit Cortez who stole her, riding her across the border into the hills day and night for 350 miles until spent and turned loose. U. S. troops in relays on fresh mounts and numerous remounts followed Cortez,—on whose head there was a big prize,—until he abandoned "Fanny." Cortez escaped. The troops led "Fanny" back the 350 miles to her owner from whom W. G. Hughes bought her at a long price.* Copyright 1903 by the Century Co. From a photograph. Reproduced here by courtesy of *The Century Magazine.*

*From a letter of the late Randolph Huntington to the writer, March 7, 1911. The San Antonio papers at the time published an account of the incident. T. C.

that in the southwest before 1860, there were many pure mustangs.* In reference to army mounts, General Carter speaks of the California mustang of fifty years ago thus: "With opportunity for selection from the herds of Chico Foster and others maintained on the ranges of the old Spanish grants of Southern California, there was little difficulty in finding horses that possessed tremendous endurance and that carried with apparent ease a trooper and the equipment, averaging one-fourth the horse's own weight and without forage other than that obtained by grazing at night in herds."[8-524]

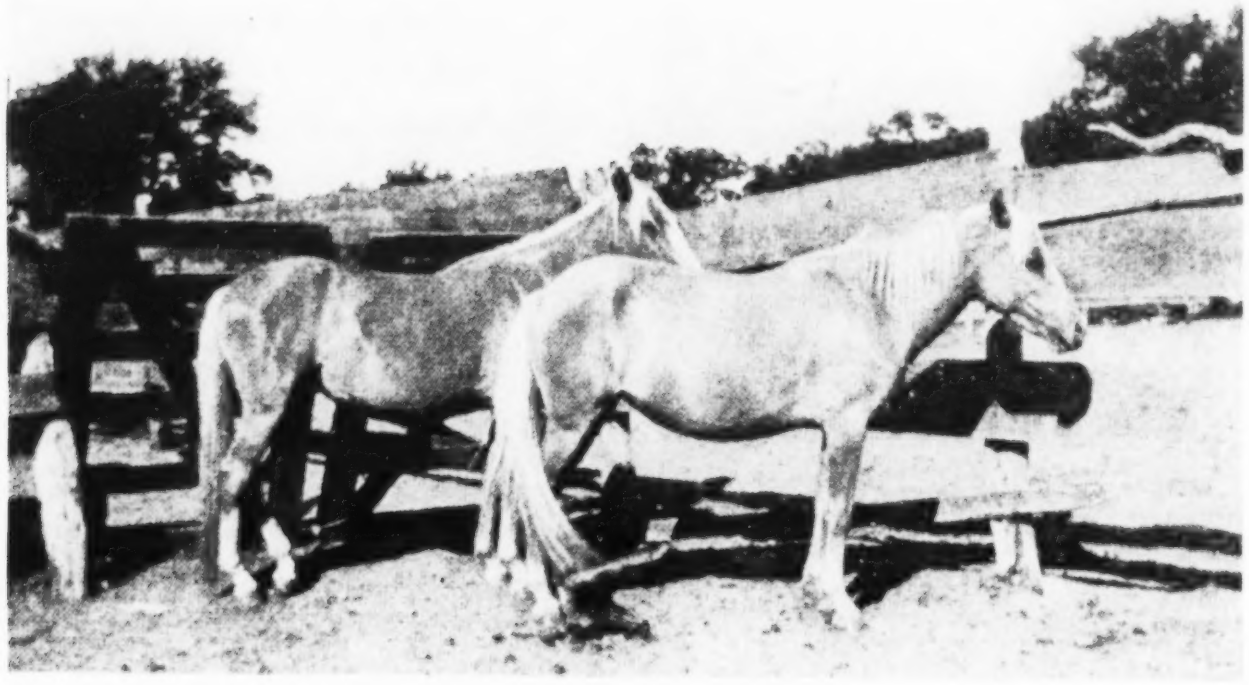
Another reference to California mustangs will be read with discrimination by horsemen. It runs as follows: "The *Spanish horse* introduced by Cortez into Mexico and thence into California, is small and deficient in strength and beauty, and little fitted for cart and plough, yet quick and tough, and with a record since 1846 *for remarkable riding feats.* He is, however, of a base and blotchy color and neither honest nor gentle."[2-57]

Additional evidence to bear out the superiority of the Southern California mustang for "riding feats" is the repeated reference by many writers† that the California Mexicans were the most wonderful horsemen in the world.

Besides the California mustangs, two hundred of the ponies were purchased at Salt Lake.[18-106-7] The topography of the country between Salt Lake and Southern California, would indicate that the source of this stock was Southern California. Also, a large number of ponies were purchased in Iowa and Missouri.[18-106] As the mustangs between the Mississippi River and the Rocky Mountains prior to 1870[10-104] were largely pure bred and as they had the same origin as the California mustangs, it is instructive to have a description of them for comparison. " . . . there were thousands of these inbred beautiful little ponies living on the ranges of the West, in the vast country that lies between the Valley of the Mississippi and the Rocky Mountains region. Their average weight was about 800 pounds . . . . . The colors that predominated among them were cream, buckskin or mouse color. Had never known grain. Could stand hard riding with no other food than that which they could "rustle." As blacksmith or hoofshaper

*In the years 1850 and 1860 there were respectively 21,700 and 160,000 Spanish horses running semi-wild in Southern California. (Bancroft[2] page 58 footnote.) The pure mustang was the descendant of the Spanish horse brought to Mexico.—T. C.

†Revere[16],[17] Emory,[12] Chapman,[9] and other writers.



MUSTANG MARES

Figure 3

Pure-bred Mustang mares belonging to the late W. G. Hughes, of the type that he crossed with Nimrod, to produce exceptionally hardy ponies. From photographs, reproduced here by courtesy of *The Century Magazine*.

never had tinkered with their feet or forced them to wear iron shoes, their hoofs were strong and would stand wear over the roughest kind of mountain trails. . . . . In capturing the mustangs they will cover one hundred miles in twenty-four hours for several days without food or water.[10-104,9] Of course, the horses purchased, were seselected individuals."*

Of the other breeds of horses referred to as used by the Pony Express,—"blooded horses" and "thoroughbreds"—it is interesting to note the quality of those available in Missouri and Iowa at the time that Russell, Majors and Waddell† bought their equipment.

That there was thoroughbred blood in various degrees of intensity in Missouri and other Mississippi Valley states from the earliest part of the nineteenth century, is common knowledge. (1) A large number of the most substantial settlers of Missouri were Kentuckians who brought with them the love for saddle horses and the skill for breeding them.[22] (2) Of the one hundred race tracks in the United States in 1839, each under its own jockey club, Mississippi had 8, Louisiana 8, Arkansas 4, Tennessee 10, Kentucky 17 and Missouri,‡ Illinois, Ohio, Indiana, 6.[1-9] (3) Of the 160 thoroughbred stallions in the United States in 1839, whose locations were known to the general public, 37 were in Tennessee, 36 in Kentucky, 7 in Arkansas, and 29 in the other states.[1-9]§ (4) Bruce's American Stud Book[6] shows that thoroughbred horses were owned as far west as Kansas in the

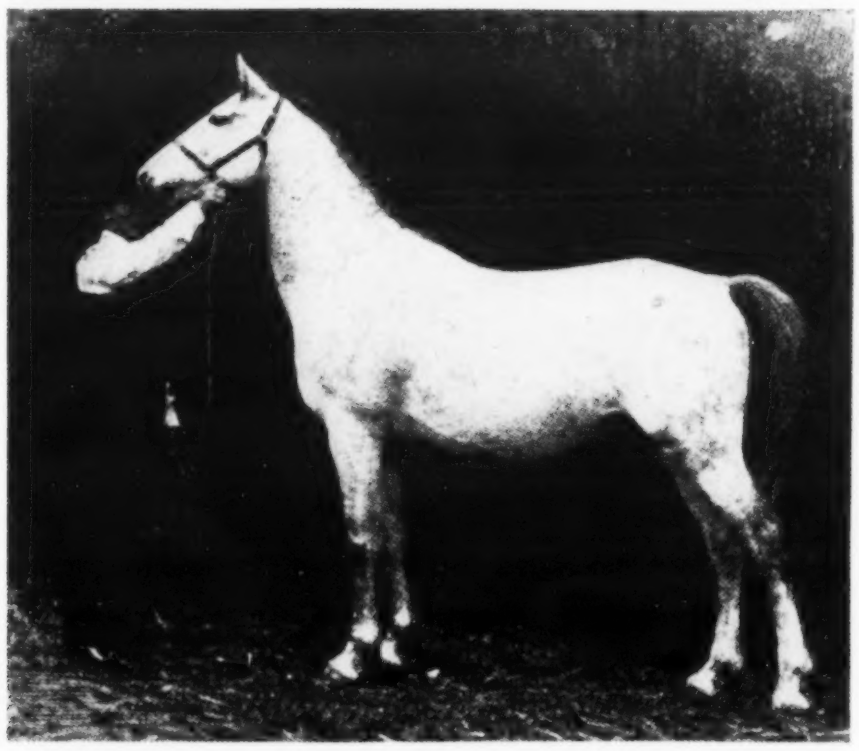
**Overland Monthly*, September, 1923, p. 9.

Arthur Peterson writing of the hardiness and courage of the western ponies says that his life was saved by "the indomitable pluck and determination of a wild little bronco mare." (*MacMillan Magazine*, Vol. 63, page 304.)

†They had the contract with the U. S. Government to carry the mails from St. Joseph, Missouri to Sacramento, California.—T. C.

‡As early as 1835 Missouri had an "Association for the Improvement of the Breed of Horses," with a constitution governing racing. In 1864 St. Louis, Mo., revived racing, generally suspended during the Civil War. (Vosburgh, "Racing in America.")

§In 1860, Missouri had 361,874 horses of all kinds. (Col. F. W. Switzler, Hist. Missouri, page 288.) In 1855, Iowa had 82,586 horses of all kinds. (N. Howe Parker, "Iowa as It Is in 1855.")



AN AMERICO-ARAB

Figure 4

Nimrod, an Americo-Arab stallion, 14¾ hands, foaled April 3, 1895, by the pure arab Nimr out of the americo-arab, Coquette, and a great grandson (on his dam's side) of Gen. Grant's pure arab Leopard. Nimrod was bred and raised by the late Randolph Huntington,* who sold him, February 27, 1901, to the late W. G. Hughes of Texas who had been searching for two years for such a stallion; and who used him on a few pure bred mustang mares, previously collected at great pains. The produce of these mares by Nimrod were bought by the late George J. Gould who shipped them to his polo fields at Lakewood, N. J.† Although they were not considered quite as fast as the English thoroughbred ponies used in the international games, they made a good showing beside English and American polo pony stock.‡ This is high praise as the ponies used in the International games are usually the pick of the world. By using the Americo-arab Nimrod on the "self bred pure Mexican Mustangs," the descendants of the arab-barb Spanish horse brought to Mexico by the Spanish explorers, Hughes thought that the domesticated mingled with the feral arab and barb blood of the same origin would produce an animal superior to both and to any other breed, for polo and ladies' saddle and driving horses. No doubt the mares of the first generation returned to Nimrod would have produced even better results than above described. Unfortunately the untimely death of Hughes cut short any further breeding; and Nimrod was bought by the U. S. War Department to improve the horses of the Philippines. Photograph copyright by the Century Co.; reproduced here by courtesy of the *Century Magazine.*

*The late Randolph Huntington was known among breeders the world over, as a student of blood influences in domesticated animals. He was, undoubtedly one of the greatest American authorities on Arab and Barb blood.

†From a letter of the late Randolph Huntington to the writer March 1, 1911.

‡From a letter of the late George J. Gould to the writer August 18, 1915.

60's;* and there are numerous listings of horses in Illinois across the river from Missouri; and in Louisiana as early as 1830.[5] Missouri itself is represented in the Stud Book from at least as early as 1834.[5-690] The general character of all such entries is indicated by one or two references as follows: "Bois d'Arc, b. h. foaled 1837; bred by B. Lofland; owned by E. L. Johnson, Esq., of Missouri. By Sir Archy of Transport. Dam by Duroc."[5-704] "Captain Absolute, br. h. foaled 1840, bred and owned by W. G. Overton, Esq., of Missouri."[5-712]

From the above it is fair to infer that there were many Kentucky saddle horses† and three-quarter, half-bred and other grade thoroughbreds in Missouri, and a good number by way of river transportation in Iowa,‡ available in 1860 for Russell, Majors and Waddell, when they purchased the "thoroughbred" and "blooded" part of the required five hundred[20-25,11] head. Moreover, the thoroughbreds of those days still had the strength and stamina demanded for long distance and heat races; which conditions were needed for the Pony Express.

*The early western pioneers were fond of good fleet horses, so thoroughbred blood was brought to the west before the days of the Pony Express; consequently ponies of good size and possessed of speed and endurance were available before 1860. (From a letter of James H. Cook, Agate, Neb., to the writer, March 22, 1926.)

†Among the saddle horse stock that came into Missouri before the Civil War was the sixteen-year-old registered stallion Rockaway (1900) who arrived in 1856, to be used extensively for breeding. (Missouri State Board of Agriculture Monthly Bulletin, October, 1913.)

‡Iowa was settled by a very substantial class of home seekers, many of whom came from Kentucky, Tennessee and Missouri.—T. C.

Endurance of Western Ponies

Your bronco is wild as the winds that blow
Over the desert, where he was bred;
Like that tempest unchained he'll go,
Swift and swifter till he is dead.[7]

Now what do the records say as to the endurance that this Spanish and "thoroughbred" blood were called upon to show? That the ponies had to be ridden hard over each stage to cover the total distance of 1966 miles from St. Joseph, Missouri, to Sacramento, California, in 8 days* is shown by the fact that the average speed was "10-6/10" miles[4-69]† an hour, or a mile in

*The regular time was 8 days in summer and 10 days in winter.[4-68] On one occasion, carrying Lincoln's inaugural address, the 1,966 miles were covered in 7 days 17 hours, which "is still the world's record for dispatch by means of men and horses." [20-19,14-185]

"The daily average was about 260 miles. The fastest European pony express, in 6-mile stages, was that from Dover to London, 80 miles. Time, 4 hours. That means at the rate of 500 miles (nearly) if kept up for 24 hours, or double the western American speed. But, then the British ponies had a superior road to travel over. The American ponies a mere trail—either all mud or all dust." (L. Lodian, *Coal Trade Journal*, Vol. 40, page 1,001.)

"After the Pony Express was discontinued, 'Pony' Bob (express rider) was employed by Wells Fargo & Company as an express rider . . . . . and he rode from "Reno, Nevada, twenty-three miles from Virginia City . . . . . for more than six months, making the run every day, with 15 horses, inside of one hour."[13-178]

Therefore, this American ride was three miles per hour faster than the English ride, But 'Pony' Bob changed every 1 and 8/15 miles; the English every 6 miles.—T. C.

†In the commemorative ride, September, 1923, one stage from St. Mary's to Abilene, Kansas, about 80 miles, was ridden at night, in the rain, over heavy roads, using 8 young horses in 7 hours and 5 minutes. (Average a little over 11¼ miles per hour.) (*Breeders' Gazette*, September 27, 1923.

RANGE SCENE IN TEXAS
Figure 6

It is in such a country as this that the Mustang developed the hardiness and endurance for which he is noted. In an arid and unhospitable region natural selection must have been a potent element in eliminating the weaklings, and in perpetuating strains having endurance and ability to "live on the country." Photograph courtesy of J. O. Williams, U. S. Department of Agriculture.

5 minutes 42 seconds.* "Ten miles distance at the limit of the animal's pace, was exacted from him."[20-26] Some parts of the route had "relays of horses at distances varying from 20 to 25 miles."[20-28]

"The horses or relays were supposed to be placed 10 miles apart and travelled a little faster than 10 miles an hour so as to allow time to change; but this could not always be done, and sometimes horses had to go 25 to 30 miles."[20-32] Buffalo Bill "made 24 miles straight with one horse."[20-52] It sometimes happened that the same horse was ridden two long stages, which on one occasion amounted to 66 miles.[20-44] And many rides of 30 miles were made without water.[14-185]

To be sure, the total weight of rider, saddle, bridle and mail pouch did not exceed 160 pounds,[4-58, 18-108] but when it is considered that half the going was at night; that the mountains had to be climbed and the rivers forded or swum; that deep snow and blinding dust had to be gone through, it is impossible to overestimate the hardiness and courage of these horses.†

*The mileage and the time necessarily varied; hence the discrepancy in these figures which are quotations. 1,966 miles in 8 days averages just under 10¼ miles per hour.—T. C.

The conditions of the 1925 Eastern also the Western Endurance Rides allowed a minimum of 45 hours for 300 miles with one horse; or 9 hours for 60 miles for 5 successive days. This is at the average rate of a mile in 9 minutes, carrying 200 pounds over a hilly country. (T. C.) The record for 1 mile on a track is 1 minute, 35 2/5 sec. made by Cherry Pie—3 years—113 lbs., at Belmont Park, Sept. 3, 1923. (World Almanac) The record for 4 miles on a track is 7 min. 10 4/5 sec. made by Sotemia—5 years—110 lbs., at Churchill Downs, Oct. 7, 1912. (World Almanac.)

†It was from animals of this kind that cow ponies were made: "The well trained 'cutting pony,' pride of its rider during the bustling days of the round up, is an animal of surprising activity and rare instinct. In fact the good cow pony is a utilitarian trick pony. . . . The slightest motion of the rider's bridle hand, or the most gentle pressure of his leg, will cause it to whirl as on a pivot, without feeling the bit; but more than that, it knows how to climb skyward on almost perpendicular slopes; it can safely jump fallen timber on slippery mountain sides; cut bank or culée, boulder-strewn mesa or gopher holed prairie, never stops its headlong speed; and when the rope's noose has dropped about the victim it knows the will of its rider without word of command." (Allen Hendricks, *Lippincott Magazine*, Vol. 60, pages 113-114.)

WILD HORSES IN UTAH

Figure 7

In the Southwest today thousands of half-wild horses still range. Many of these animals are entirely worthless, the pure Mustang blood having been lost by crossing with all kinds of stray horses. Photograph by Will C. Barnes.

The Riders

Ride for your life in the Red Skin's land;
They are waiting yonder to have their prey;
Murderous chiefs of the Pawnee band
Fired on Cody but yesterday.[7]

If the horses showed wonderful stamina, what shall we say of the will-power of the riders whose physical endurance, high morale and bravery are described in the following quotations: "But few men can appreciate the danger and excitement to which those daring and plucky men were subjected, it can never be told in all its constant variety . . . . . they possessed strong wills and a determination that nothing in the ordinary event could balk."[13-169] "The riders had a division of from 100 to 140 miles" (on some parts of the route). "Some portions of the dangerous route" (hostile Indian country) "had to be covered at the astounding pace of 25 miles an hour."[20-28] "I made the longest ride without a stop, only to change horses. It was said to be 300* miles, and was done a few minutes inside of 24 hours." (Keetley made this emergency ride averaging 12½ miles an hour, starting from St. Joseph.)" ". . . . . At the start the men rode 100 to 125 miles but . . . . . later 75 to 80."[20-32]

Other emergency rides, made necessary by the sudden illness or wounding of a rider, were those of Jim Moore, who on June 8, 1860, rode from Midway Station to Julesburg and return, 280 miles in 14 hours 46 minutes† averaging over 18 miles an hour, stopping only to change from one pony to another;[4-104,20-39] and that of "Pony Bob" Haslam who carried the news of Lincoln's election, galloping the 120 miles from Sutters Creek to Ft. Churchill in 8 hours and 10 minutes, an aver-

*Bradley says that Keetley made 340 miles without rest. "He travelled continuously for 31 hours, his entire run being at the rate of eleven miles an hour."

†Visscher gives the time as 22 hours, which is less than 13 miles an hour; and is more within reason.—T. C.

age of 14-7/10 miles per hour (average 4 minutes 5 seconds per mile) using thirteen relays of horses.[4-69,20-44] At another time he rode 190 miles stopping only to eat and change horses. But his greatest ride, carrying the mail through a country where the Indians were on the warpath, when other riders failed or were wounded, was 380 miles which he made within a few hours of schedule time with scarcely eleven hours lay off.[4-126,20-45] Part of this ride was made on tired horses because some of the change stations were burned and the remounts driven away by the Indians.*[20-45]

Buffalo Bill's experience as an express rider, included one ride of 322 miles on time;[20-51] this meant top speed; and a ride of "324 miles without sleep, stopping only to eat, and only for a few minutes."[20-59] "Cody averaged 15 miles an hour."[4-128]

Of the entire ride of 1,966 miles "the trail covered nearly 600 miles of rolling prairies, intersected here and there by streams. . . . ." In the mountains "the men and horses had to endure such risks as rocky chasms, snowslides and treacherous streams, as well as storms of sand and snow . . . . for several hundred miles the route ran through a desert . . . . . of alkali dust where no living creature could long survive."[4-37] And of the total distance ridden, 650,000 miles, during the nineteen† months' existence of the Pony Express, there is the remarkable record that only one mail was lost.[20-29]

It is safe to say that any understanding horseman who for the first time reads the details of these heartbreaking rides, will uncover out of respect for these horses and riders, and wonder why they were not honored by a suitable celebration till the Autumn of 1923‡ and why no poet was inspired to relate the heroism of horses and men until 1925.

Lost is the trail in the desert sand—
And the wolf still howls as he did of yore,
But never again in the lonesome land
Will the riders ride as they rode before.[7]

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*"Pony" Bob watched the ears of his pony to detect Indians in ambush.

†April 3, 1860, to October 26, 1861. (Judge Greene Majors.)

‡In 1912 a monument was erected to mark the starting point of the Pony Express at St. Joseph, Missouri. In 1923 the ride was repeated, celebrations on a large scale all along the old route were had; and a tablet was dedicated at Sacramento, the Western terminus.—T C.

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"Physiological Psychology"—A New Variety

THIS interesting volume* is a compilation of twelve lectures delivered before the People's Institute on the subject of Behaviorism. The first startling fact which the reader meets is the news that behaviorists suddenly founded a new Science of Behaviorism in the year 1912. This new psychology is thus defined:

> Behaviorism is a natural science that takes the whole field of adjustments as its own. Its closest scientific companion is physiology. Indeed you may wonder as we proceed whether behaviorism can be distinguished from that science. It is different from physiology only in the grouping of its problems not in fundamentals or in central viewpoint. Physiology is particularly interested in the functioning of parts of the animal,—for example, its digestive system, the circulatory system, the nervous system, the excretory system, the mechanics of neural and muscular response. Behaviorism, on the other hand, while it is intensely interested in all of the functioning of these parts, is intrinsically interested in what the whole animal will do from morning to night and from night to morning.

From this definition it is clear that behaviorism is nothing but the study of behavior and since man is an animal it follows that the study of animal behavior took root as recently as the year 1912, A.D., growing by leaps and bounds until it has largely replaced the introspective and functional psychology of the past. Those acquainted with the history of biology will find this statement especially edifying. Certainly the study of animal behavior had its beginning many years before the dawn of the twentieth century.

Of particular interest here is the chapter "On the Subject of Talent, Tendencies and the Inheritance of all So-called Mental Traits." In this chapter Dr. Watson attempts to trample the geneticist under foot, discard his results, which have been obtained "working under the banner of the old 'faculty' psychology," and in their place bring out sweeping conclusions which are in many cases entirely unsupported by data of any kind. The author is inclined to give an undue amount of weight to the environmental factors and to regard very lightly, if at all, the value of heredity in the development of the human being. He states: "I wish to draw the conclusion that there is no such thing as an inheritance of *capacity, talent, temperament, mental constitution* and *characteristics.*" According to this thesis each individual of the genus Homo comes into this world a raw product composed of the same materials as every other individual, but lacking everything in the way of hereditary foundation which will later limit his mental development. His mental constitution, temperament, the particular talent which he will

*Behaviorism, by John B. Watson, formerly Professor of Psychology and Director of the Physiological Laboratory, Johns Hopkins University. Lecturer, the New School for Social Research, p. 250. The Peoples' Institute Publishing Co., New York, 1925.

display and the capacity of his mental factory will be manufactured and installed for him during developing youth by the behavioristic specialist.

Even the geneticist will admit that talent and mental tendencies are not inherited as such and he will readily grant that capacity to learn and mental constitution are not inherited in a simple Mendelian fashion. This is quite a different thing from throwing genetics overboard and saying that heredity has no influence upon the mental activities of man. Indeed, the author goes so far as to say, "Give me a dozen healthy infants, well formed and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief, and, yes, even beggar-man, and thief, regardless of his talents, penchants, tendencies, abilities, vocations and race of his ancestors." On the face of it, this is a very broad and dangerous statement, but Dr. Watson doubtless means by "healthy infants" individuals with a mental heredity capable of expansion in any one of various directions.

That the author does not entirely disregard the possible importance of heredity is indicated in his discussion of the three hypothetical sons of the great economist Wesley smith. "Suppose Wesley Smith had had three sons who by hypothesis all had bodies so made up anatomically and physiologically that each could put on the same organization (habits) as the other two." Then he says in a footnote "And by this statement we do *not mean that their genetic constitution is identical.*" In other words, all infants are anatomically and physiologically the same at birth but differ genetically and all changes which take place during post natal life are determined by the environment. It is indeed pleasing to know that genetic differences do exist, even though Dr. Watson is unable to ascribe any value to them. He has only added to the general confusion by disregarding all genetic data and then by proving nothing by means of behaviorism.

In spite of all the faults which may be found with the book, it contains much material of value to psychologists and anthropologists. Considerable space is devoted to infant behavior concerning which some very interesting observations are recorded. *H. C. M.*

The Progress of Social Science

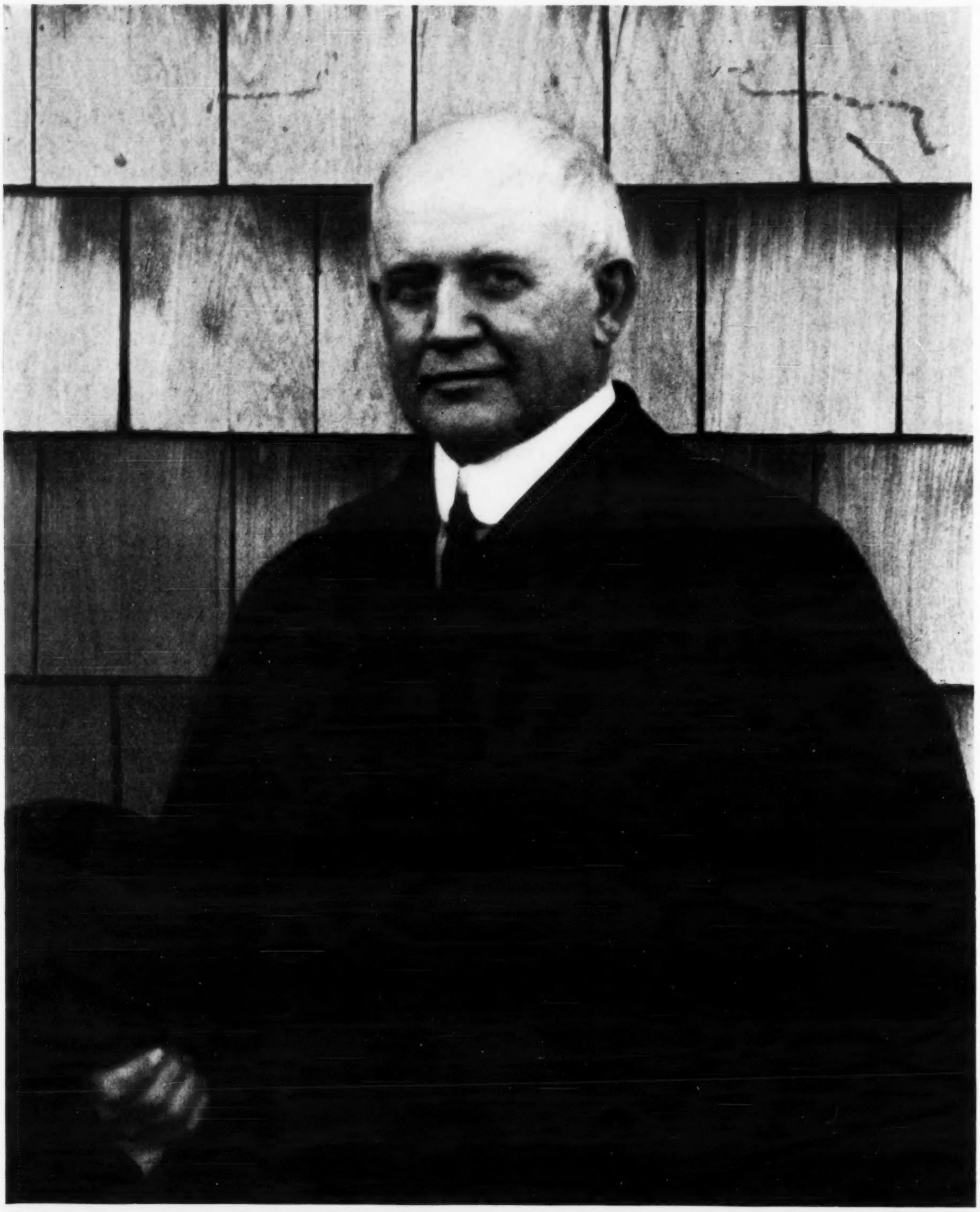
THE TREND OF OUR CIVILIZATION; Publications of the American Sociological Society, Vol. XIX., ed. by ERNEST W. BURGESS. Pp. 264, price $2.00. University of Chicago Press.

This volume of the proceedings of the nineteenth anual meeting of the American Sociological Society is of direct value to eugenists. It contains many articles that are interesting, many that are important. Those dealing with the biological aspects of racial problems serve particularly to show that these questions constitute one of the fields that most needs further work. There are a number of useful statistical papers.

P. P.

A Correction

Through a blunder Figure 8 in the September number (Page 328) appeared upside down. Unfortunately the printer neglected to invert the legend too, thus introducing a serious inaccuracy. As the cut appeared, the concave maize seeds were at the top, the normal seeds at the bottom,--and not in the reverse positions as intended.



WILLIAM EDWIN SAFFORD

For many years Dr. Safford was a member of the Washington Biologists' Field Club, which has its headquarters on Plummer's Island near Washington. This photograph, which his friends consider the best in recent years, was made at Plummer's Island on November 14, 1920, at the annual oyster roast of the Club. Photograph by C. R. Shoemaker.

WILLIAM EDWIN SAFFORD

(1859-1926)

THE death of William Edwin Safford on January 10, 1926, left a gap in the ranks of American botanists that will not soon be filled, for Doctor Safford had made for himself a unique place in his chosen science. The list of his published writings runs to some 80 titles and of these papers a very large majority deal with plants in their human relationships.

To those who knew Doctor Safford there was no mystery in his preference for this phase of botany. He was first and foremost a student of mankind. People of every race and place aroused his interest, an interest not merely scientific but infused with the kindly sympathy that was the very essence of the man. His keen interest in humanity led him to the study of ethnology, philology and archæology, and his amazing capacity for observation and deduction and his great linguistic ability brought him distinction in these fields of research as well as in biology.

Doctor Safford was born at Chillicothe, Ohio, in 1859 and graduated from the United States Naval Academy in 1880. His cruises as an officer of the Navy and his service in 1899 and 1900 as vice-governor of the island of Guam gave him rare opportunities for biological and ethnological investigations in the islands of the Pacific and on the west coast of South America. How well he availed himself of these opportunities is shown by such publications as "Botanizing in the Strait of Magellan," "Extracts from the Notebook of a Naturalist on the Island of Guam," "Chamorro Language of Guam," and his magnum opus "Useful Plants of the Island of Guam."

In 1902 Safford resigned from the Navy and accepted an appointment in the Office of Economic and Systematic Botany of the Bureau of Plant Industry, United States Department of Agriculture, a post which he held to the end of his life. During this period he published numerous papers on the systematic botany of the Annonaceae, the mainly tropical family to which our familiar papaw belongs, on the genus Datura and other groups. But no subject appealed to him more at this stage of his career than the uses of plants by the aboriginal populations of North and South America. "Food Plants and Textiles of Ancient America," "Magic Plants of Ancient Americans," "Narcotic Plants and Stimulants of the Ancient Americans," and "Use of Nuts by the Aboriginal Americans" were among the many papers on this subject which appeared during the last ten years of his life. He published also on the sacred flowers of the Aztecs and on "lignum nephriticum," a wood whose singular properties had stirred the curiosity of naturalists in the sixteenth and seventeenth centuries.

The JOURNAL OF HEREDITY had the privilege of issuing Doctor Safford's last published contribution, "The Potato of Romance and of Reality."* It is a most interesting account of the misconceptions regarding the origin of the potato which prevailed in Europe long after its introduction from the New World. Even to those who knew Safford well, the erudition displayed in this paper is surprising. It is also a fine example of his skill as a writer.

At the time of his death Doctor Safford, in collaboration with his beloved wife, was engaged in the preparation of a volume on the "Useful Plants of Mexico," based largely upon the notes and collections of the late Dr. Edward Palmer. If he had lived to

Journal of Heredity 16:113-126, 175-184, 217-230. 1925.

complete this work it doubtless would have taken rank as his most important contribution to American botany.

It has been possible, in this notice, to touch upon but a few of Safford's multifarious interests and attainments. He loved literature, music and painting, and his knowledge of these arts was varied and profound. His many-sidedness made him a fascinating companion and his warm-heartedness endeared him to all who knew him. His family life was of ideal beauty and his devotion to the wife and two children who survive him could not have been surpassed. *T. H. K.*

William Edwin Safford, The Man*

TO properly describe the life of a man and especially the rich life of such a man as Dr. Safford is no easy task. The person who undertakes it should be well documented and have considerable time at his disposal.

I have proposed to myself something much easier, namely, to give a few impressions of the man, leaving the critical study of his scientific attainments to other hands.

Ned Safford was like a brother to many of us and we shall miss him greatly. His social instincts were strong. He had a genius for friendships. He radiated sunshine. In the 23 years he has been going in and out among us we have had ample opportunity to discover all his essential traits. He was incapable of hatreds. If he had any enemies I have never discovered them and certainly he had a host of warm friends. He was catholic in his tastes and his ability to see both sides of an argument tended to disarm hostility. He was like Renan in his charities and in many other ways. His was a smiling happy nature. He was short, thick-set, ruddy, active, always clean shaven, with good features. a round rather than a long head, blue eyes and brown hair.

Dr. Safford loved Nature profoundly and humanity not less.—All yellow and brown races were brothers to him. Catholics, Protestants and Agnostics, all were his friends. It was the kindly spirit in a man and not the color of his skin or the dogmas he professed that counted with him.

His enthusiasms knew no bounds, and they were generally for worthwhile things. He pursued his beloved studies year after unweariedly. Like Browning's Grammarian, there was always more to be learned and rest might come later. Humanity, social life, science, letters, the arts—he knew and loved them all. In some ways he was more like a man of the Renaissance than like a modern American. He was a worshiper of the beautiful as few men I have known have been, whole-heartedly and with a passionate adoration. The beautiful was to him a religion.

Dr. Safford was a good linguist and an omnivorous reader. He was perfectly at home in French and Spanish and had a good working knowledge of Latin, German and Italian. When he was in Guam he also interested himself in the native language. He had read many great books not related to his botanical and anthropological researches and he had a wonderful *flair* for out-of-the-way and interesting things. For instance, it was he who called my attention to Andrew Lang's "Letters to Dead Authors" and to Helena Vacaresco's French translation of Roumanian folk-songs, tender, melancholy, wild, and fierce outpourings of the peasant soul. His interest in primitive peoples and their ways was second only to his love of plants.

His years of wanderlust had taken

*Read before the Washington Botanical Society, February 2, 1926.

him everywhere. He had known many kinds of men and women, had seen many parts of the world, and his mind was a rich storehouse of fact and fancy drawn from a thousand places, and from books and pictures and conversations innumerable. His was a rich, full life and he shared his treasure-trove with every congenial spirit, with everyone, indeed, who would listen. He loved conversations. How many happy hours I have passed with him discussing all sorts of interesting things in Nature and the world of men, and no one ever talked with him long without getting new ideas and a broader outlook. First and last, I saw a great deal of him. Our scientific work did not throw us together very much, but in social life, in his home and in my own, in the Arts Club and in the Literary Society, in both of which he was very active, I met him a great many times and found him always a congenial spirit. It was he who put on at the Arts Club some years ago that interesting program: "What Does Nature Mean to You?" which was discussed by half a dozen persons from different angles, the writer being one of them. There one of the sculptors opened his remarks by saying: "Nature is a fool!" but Safford did not think so, and neither do I.

For the last two years of his life Dr. Safford was a prisoner in his own house and most of the time confined to his own room, following an apoplectic stroke. Through it all he was cheerful and continued with Mrs. Safford's help to work as best he could. In some ways, these last two years were his best years because they withdrew him from the whirling busy world and enabled him to enjoy in peace and quiet his wife and children and that dear home life of which he was so fond. During these years also he was allowed occasional glimpses of his friends.

In my opinion Dr. Safford has served his generation faithfully. I keep many pleasant memories of him, and we are all the richer for having known him.

The following sonnet which I wrote and gave him when he was first taken ill was read at his funeral service. It expresses my understanding of the man, but only very inadequately.

A NATURE LOVER

To W. E. S.

Within his soul, as in a Buddhist shrine
The god, a gentle Nature-worship glowed;
He saw upon Earth's face where'er he strode
Footprints of God and finger-marks divine.
The breath of peace in lily, palm and pine,
The long allurement of the open road,
By suns and winds and water overflowed,
Were more to him, entranced, than bread or wine.

He heard in Nature voices manifold;
Beyond the known he seemed to catch faint gleams
Of deeper and diviner things untold;
Therefore, the hills sang to him and the streams,
The dross of other men became his gold,
And all his days were full of wistful dreams.

Erwin F. Smith.

AGE AND QUALITY OF OFFSPRING

The Effect of Age of Parents on the Quality of Offspring in Cattle

A. C. CHAUDHURI

Animal Breeding Research Department, University of Edinburgh

SOME work has been done on the relationship of the age of the dam to fertility and fecundity in different animals, but the literature on the relation of the age of the parents and the quality of the offspring does not seem to be satisfactory. Many breeders doubt whether the offspring of aged parents is as good as that of young ones. The greatest age at which a cow can breed is still somewhat doubtful. The Aberdeen-Angus foundation cow, "Old Grannie," produced a calf in her twenty-ninth year. Jones and Rouse[4] record a cow calving at the age of thirty-three, and two multiple births at the age of twenty-five in the American Hereford and Aberdeen-Angus herd books respectively. In the horse, Wood[6] records a thoroughbred mare breeding at thirty-three, and two more at thirty, while in the sheep Pearl[5] has noted a remarkable ewe which produced a lamb in her seventeenth year. These are merely some figures to show the limit: the average age at which a cow stops breeding is considerably lower. There is no record as to the relative quality of the offspring of a particular individual according to age.

In order to present some data concerning this, the prizewinners in the Shorthorn classes at the Highland and Agricultural Society's show (the leading show in Scotland) and their parents were studied, the ages of the parents being traced in Coates' Herd Book. The lists of premiums recorded were from 1902-1925, excluding four years when no shows were held, thus leaving records of over twenty shows. Records were made of the first five prizewinners of each class excepting those in which there were only a few entries, and these were eliminated. To each first prizewinner five points were awarded; to the second, four; and so on, the fifth getting one. The date of birth of these winners were recorded, also the ages of their dams and sires at that time. As, for various reasons, most animals are not allowed to live as long as they are capable of breeding, it was thought desirable to compare the number of points gained by cows of a certain age as parents of prizewinning offspring, with the number of cows calving at that age in a similarly controlled population. For this the ages were ascertained of a number of the cows which calved in the age periods, between volumes 58 and 70, both inclusive, of Coates' Herd Book. These volumes cover the greater part of the population from which the winners came. The age of the dam of every hundredth birth was recorded, amounting to 2,078 births.

The data thus collected are tabulated in Table I.

While the figures cannot be regarded as in any way significant, or definite, they are perhaps suggestive. From columns 1 and 2 it may be noted that the maximum number of prizewinning offspring belong to dams who calved at three and four years, but this is balanced by the fact that Shorthorn cows are more regularly served to calve at that age (column 4) and indeed the number of points gained per hundred cows at that age differs little from any other age (column 5). The average number of points per hundred cows increases perhaps with age, but this, if it is so, cannot be regarded as significant, for

it is only natural that breeders should retain in their herds for a rather longer period cows which they recognize as giving rise to offspring above the average. A study of these figures also shows that with an advance in age more and more breeding cows are disposed of, the disposal starting in the third year but not severely until the fourth. From the fourth to the seventh year there is a heavy reduction, then a slight easing off till the ninth, after which it is somewhat more gradual.

As regards the age of the sire on the quality of the offspring, results are somewhat similar. Six more winners are included in this study, it having been impossible to trace their dams. It is interesting to note that the greatest number of prizewinners are produced by sires which were two years old when their prizewinning progeny were born. This is logical, and it shows that a good many breeders prefer to use young bulls, which is in accord with the common practice in Shorthorn herds in Scotland.

Donaldson[2], working with rats, finds that the birth weight increases with the increasing age of the dam. This is due rather to an environmental cause than to a genetic one. Eckles and Palmer[3] state that neither the percentage composition of the milk nor the physical and chemical constants of milk fat from aged dairy cows show any abnormalities attributable to old age. They further record that butter made from the milk of a cow nineteen years old was pronounced to be of excellent quality. Allen[1], working on the ages of the sires and dams of cows under three age groups according to their seven days butter-fat production (Advanced Registry, American Holstein Friesian), concluded that the parentage of superior or high producing dairy cows is no older than the parentage of

TABLE 1—CLASSIFICATION OF PRIZE WINNING SHORTHORN CATTLE ACCORDING TO THE AGE OF PARENTS

	According to the Age of Dam							According to the Age of Sire			
	1	2	3	4	5	6	7	8	9	10	11
Age of Dam or Sire	No. of Winners	No. of points gained by winners	No. of points per winner	No. of cows calving in age period in hundreds	No. of points per hundred cows calving	Per cent. of total points	Per cent. of total no. of cows calving	No. of winners	No. of points gained by winners	No. of points per winner	Per cent. of total points
2	51	164	3.21	191	0.85	9.66	9.19	183	550	3.00	32.04
3	95	315	3.31	416	0.75	18.57	20.02	153	480	3.13	27.96
4	100	299	2.99	381	0.78	17.62	18.34	88	278	3.15	16.19
5	71	212	2.98	291	0.72	12.49	14.00	44	122	2.77	7.11
6	57	185	3.24	234	0.79	10.90	11.26	37	121	3.27	7.05
7	46	150	3.25	173	0.86	8.84	8.33	27	97	3.59	5.65
8	43	131	3.04	138	0.94	7.72	6.65	8	29	3.62	1.68
9	31	103	3.32	102	1.00	6.07	4.90	7	22	3.14	1.28
10	15	39	2.60	52	0.75	2.30	2.50	6	13	2.16	0.75
11	15	35	2.33	36	0.96	2.06	1.74	2	5	2.50	0.29
12	10	20	2.00	32	0.62	1.18	1.54				
13	7	21	3.00	14	1.50	1.23	0.68				
14	3	4	1.33	10	0.40	0.24	0.48				
15	1	3	3.00	5	0.60	0.19	0.24				
16	3	11	3.66	1	11.00	0.64	0.04				
17	-	-	-	2	-	-	0.09				
18	1	5	5.00	-	-	0.29	-				
Total	549	1,697		2,078		100	100	555	1,717		100

comparatively inferior or low producing cows.

These results are in accord with those presented in this paper. While the figures herein shown are only suggestive and in no way conclusive, nevertheless there is nothing that can be deducted from them to show that there is either a decrease or increase of quality according to the age of the parents. This result is in accord with accepted genetical theories.

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Speech of Chimpanzees

Chimpanzee Intelligence and Its Vocal Expression—in two parts: 1. Traits of young chimpanzees *by* Robert M. Yerkes. 2. Voice and "Language" of young chimpanzees *by* Blanche M. Learned. Pp. 157. Price, $3.50. William & Wilkins Company, Baltimore, 1925.

A scientific study of our distant cousins the primates has been even more neglected than the study of man himself. Koehler's work in the Canary Islands, has recently attracted considerable attention, but unfortunately this has been discontinued for lack of funds. The present book is a "contribution to our knowledge of the traits and sound expression of the young chimpanzee and is presented humbly as the first chapter of a continued story."

The hero and heroine, "Chim" and "Panzee," came under observation when they were about three years old. The book is a report of their activities for ten months.

The history of the chimpanzees' physical traits, mental traits, evidences of insight, and sound and speech are dealt with by Dr. Yerkes. Miss Learned lists the sounds that are associated with food and with other objects. A few sounds seemed to have a definite significance, but persistent efforts failed to enlarge the chimpanzee vocabulary.

It is noted that "Their imitative tendency is as remarkable for its specialization and limitations as for its strength. It seems to be controlled chiefly by visual stimuli. Things that are seen tend to be reproduced. What is heard is not reproduced."

The authors believe that this is the reason why the chimpanzee has not attained a spoken language. It would seem that an even more important faculty is undeveloped — the power of association. Imitation is not enough to connect a sound or a sign with a wholly extraneous object, and without symbolism the simplest language seems an impossibility. If it were only that the speech faculties were linked with sight rather than with hearing, we might expect that the primates would have developed a sign language.

R. C.

BREEDING IMPROVED VARIETIES OF SMOOTH-AWNED BARLEYS*

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SEVERAL years ago Harlan,[3] of the Office of Cereal Investigations, Bureau of Plant Industry, pointed out the economic value of smooth-awned varieties of barley. He emphasized the unpleasant task of handling rough-awned varieties during harvesting and threshing which he believes has limited the barley crop. Descriptions were made of the early importations of smooth-awned varieties into the United States, and various cooperative breeding studies with several of the state stations which date from 1912 were mentioned.

The early work of Perlitius[10], Schmid[11] and of Zoebl and Mikosch[12], as well as the more recent studies of Harlan and Anthony[4], Grantham[1], and those carried on at Minnesota[7] have furnished conclusive evidence that, as a rule other characters being equal, the awned varieties of wheat and barley may be expected to yield more than awnless varieties of wheat or hooded varieties of barley. In a study of the value of smooth awns in barley a comparison was made[9] of the transpiration of spikes of smooth- and rough-awned varieties. As a result of these studies and of preliminary yield trials it was concluded that smooth-awned varieties have no physiological limitation when compared with standard rough-awned sorts.

A good idea of the difference in the development of teeth on the awns of smooth- and rough-awned varieties can be obtained by comparing photographs of awns of Lion and of Manchuria (Figures 9 and 10). The tip of the awns frequently breaks off before harvesting time so that with Lion the small part of the awn which produces teeth is lost before maturity and superficially the variety appears to produce absolutely smooth awns.

Harlan and Pope[6] have used the breeding of smooth-awned barley as an illustration of a method of back-crossing which they suggest is a desirable plan when one parent contains only one desirable character, such as smooth awns, and the other parent all other desirable characters. The F_1 plant of a cross is back-crossed to the desirable parent and the F_1 of this combination back-crossed again to the same parent. Every few years the second generation is grown and the plants selected for the desirable segregates such as smooth awn. One of the reasons for this method was the early failure to obtain smooth-awned varieties which were as desirable as Manchuria.

In the Minnesota cooperative barley breeding studies which have been intensively carried on since 1915, ordinary Mendelian methods have been followed and several varieties have been obtained which in rather extensive trials appear equal or superior to Manchuria. While the better hybrids from the first series of crosses have been recrossed

*The studies of reaction to *Helminthosporium sativum* have been carried on cooperatively between the sections of Plant Breeding and Plant Pathology and have been published in considerable detail in previous papers. Acknowledgment is made to Dr. E. C. Stakman and Dr. J. J. Christensen of the Plant Pathology Section and to Dr. Fred Griffee, formerly assistant plant breeder, whose cooperation made possible the studies of disease resistance. Barley breeding at Minnesota has been aided by the cooperation of Dr. H. V. Harlan of the Bureau of Plant Industry.

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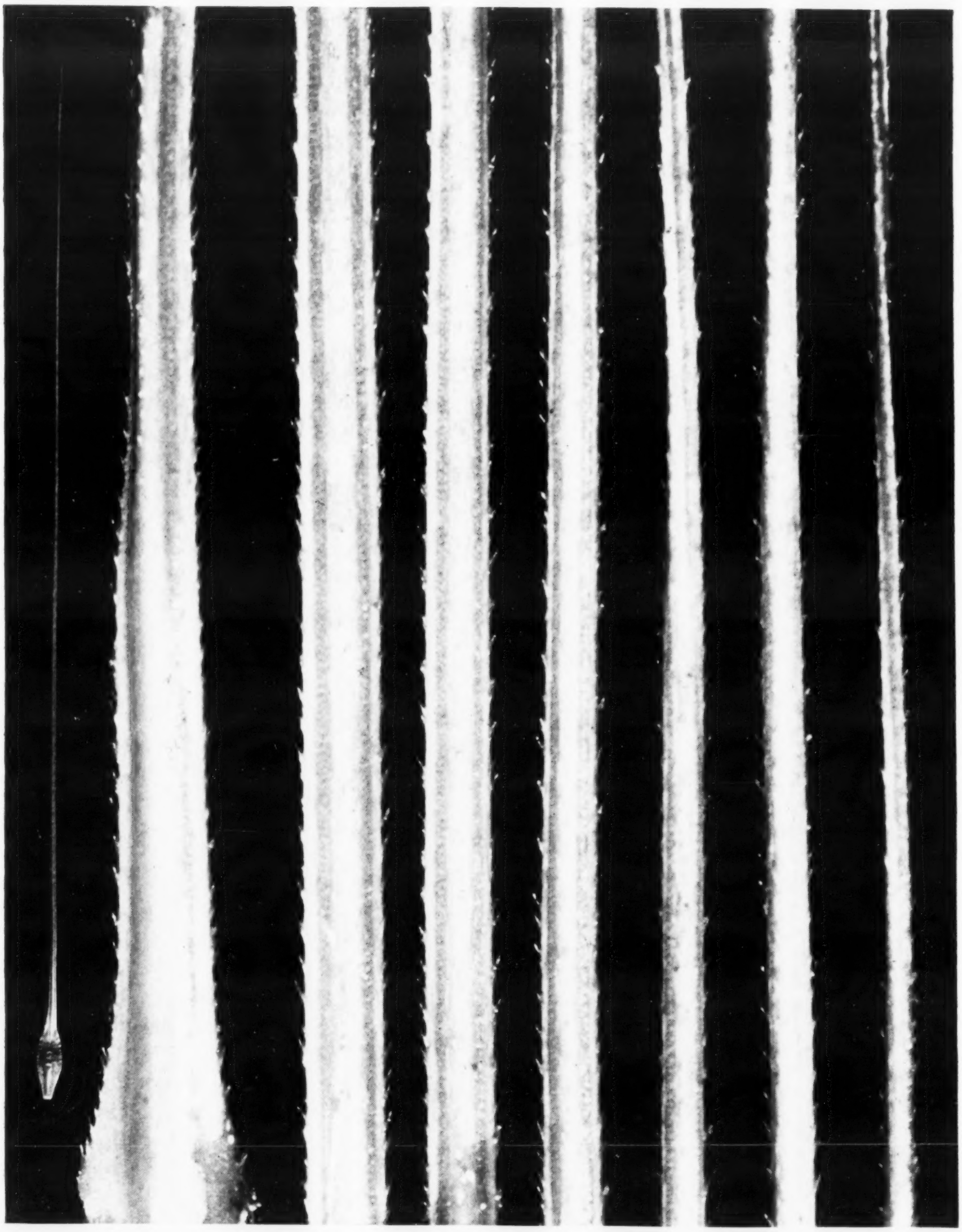
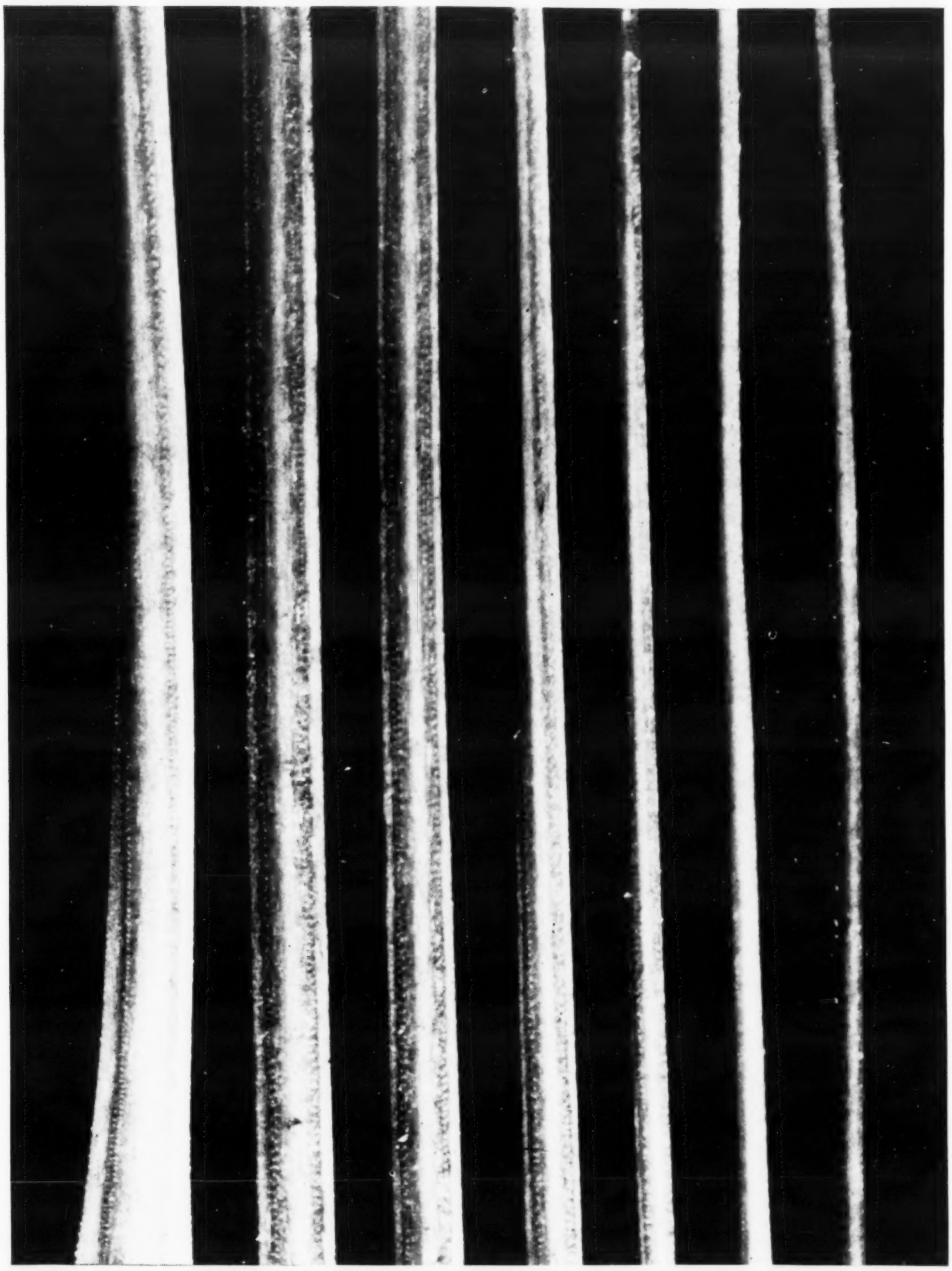


AN AWN OF MANCHURIA BARLEY

Figure 9

Manchuria is the standard awned variety in Minnesota. The barbed awns are the chief reason why barley is not a more popular crop. At the left is shown natural size a kernal of barley with the awn attached. The enlarged photograph shows such an awn broken into pieces, so that all of it could be gotten on the plate. In addition to the barbs on the edges, there is a row on the side of the awn facing the reader, but this hardly shows here. Photograph by E. L. Crandall and Robert Cook.



AN AWN OF LION BARLEY

Figure 10

This is the smooth awned parent of the successful varieties produced by the Minnesota station. The barbs are limited to a few at the extreme tip of the awn, a part which frequently breaks off before harvest time, when the rough awns are objectionable. The new smooth awned selections have awns as free from barbs as those of Lion, and all the other desirable characteristics of the best rough awned varieties. Photograph by E. L. Crandall and Robert Cook.

with Manuchuria, the results have been obtained by growing large F_2 populations, a considerable number of F_3 families, several hundred lines in rod rows for a preliminary comparative trial, and the final test of a few of the better sorts in 1/40th acre plots. The failure of the early crosses was apparently due to susceptibility to attacks of *Helminthosporium sativum* P. B. and K., and in the second series of crosses resistance to this disease has been given special attention[8]. The mode of attack used has the advantage of allowing more intensive study of the factors involved and for this reason is probably superior to the method suggested by Harlan and Pope, although their plan may be desirable in some cases.

The purpose of the present paper is to describe the methods used in the breeding of desirable economic varieties of smooth-awned barleys and to present a brief history of three desirable smooth-awned varieties which have been obtained. The successful completion of the task of obtaining desirable smooth-awned varieties, in spite of the difficulties, emphasized by other writers, gives added confidence in present-day methods of plant breeding which, in this case at least, may be said to be the direct application of Mendelian principles.

The First Attempts to Obtain Desirable Smooth-Awned Sorts

The early crosses of Harlan in which various smooth-awned sorts have been crossed with standard varieties have been mentioned. The first crosses for the Minnesota experiments were grown in 1912. Smooth-awned plants which appeared desirable were selected in the segregating generations and during the period from 1916 to 1918 some of the more promising smooth-awned varieties were compared in rod row trials with the better strains of Manchuria[5]. Several of these yielded as well as Manchuria in the rod row trials and were placed in 1/40th acre trials at the Central station in St. Paul and at the Branch experiment stations in Crookston, Morris, Waseca, Grand Rapids and Duluth. In the more extensive tests the smooth-awned sorts did not yield as well as Manchuria, on the average, although in some seasons they were the equal of Manchuria. At Morris there was a severe epidemic of a disease which was found by the pathologists to be caused by *Helminthosporium sativum* and which is commonly called "spot blotch." This led to a cooperative attack on this phase of the problem and it was learned that all smooth-awned hybrids available were more susceptible to "spot blotch" than Manchuria. Practically all of these smooth-awned hybrids were white-grained segregates of crosses between a black, smooth-awned, six-rowed variety called Lion and standard white-grained, six-rowed varieties. The greater susceptibility of the hybrids appeared to be the sole cause for the first failure to obtain desirable smooth-awned sorts and a new series of crosses was undertaken. This second series of crosses was made by Dr. Harlan and the F_1 generation grown the same year in the Washington greenhouse. Subsequent breeding studies have been carried on in Minnesota. In the second series of crosses one of the better smooth-awned, white-grained strains from the first cross was used as one parent and various desirable six-rowed, white-grained varieties used as the other parent. This is the method of back-crossing which has been used consistently in the Minnesota plant breeding studies. It is the application of genetic principles which makes possible a careful study of the genetic factors involved. Before presenting a brief history of the new varieties the importance and nature of resistance to *H. sativum* will be discussed.

The Importance and Nature of Resistance to *H. Sativum*

Extensive studies of the reaction of barley varieties and strains to *H. sativum* have been made in Minnesota.[8] The degree of injury to any variety

caused by *H. sativum* is strongly influenced by the environmental conditions under which the crop is grown. In other words, resistance or susceptibility is a relative character and is not absolute. There are, however, marked inherited differences in the degree of infection under comparable conditions. In the present study there was a heavy natural epidemic in the plant breeding plots of the F_3 and F_4 hybrids, each line of which was the progeny of a single plant selected the previous year. Resistant plants and lines were selected, the selections being made on the basis of desirable agronomic appearance and the extent of leaf and culm infection (see Figure 11). As soon as the lines appeared homozygous they were placed in rod row trials and were grown in a specially prepared disease nursery in five-foot rows planted at the rate of 5 grams of seed per row. The following description of methods of studying reaction to *H. sativum* is quoted from a previous publication[8]:

The varieties were grown in infested soil and were sprayed at about heading time at intervals of a day or two with spore suspensions of *H. sativum*. The spraying was done between 7 and 8 p.m., from three to five sprayings being made.

Data on the degree of infection were taken when the barley was nearly mature. Separate notes were taken on the degree of infection of heads, culms and nodes, and roots. The terms "heavy," "medium," "light," and "trace," were used to denote degrees of infection; and plus and minus signs further to differentiate the severity of the infection. For more exact comparisons, the various degrees of infection were denoted by numerical figures as follows:

Trace = 10	Medium − = 6	Heavy − = 3
Light = 8	Medium = 5	Heavy = 2
Light − = 9	Medium + = 4	Heavy + = 1
Light + = 7		

These figures allowed a summary of the infection of the separate notes taken on three different parts of the plants, i. e., spike, culm and leaves together, and root, and also aided in determining the degree of correlation between reactions obtained in successive seasons or between the degree of infection of different parts of the plants of the same varieties.

The degree of infection of a variety was obtained by adding the infection note from the three separate parts of the plant, spikes, culms and leaves taken together, and roots. It is apparent that the highest possible degree of resistance possible would be expressed as 30. A comparison of the infection of Lion, the original black, smooth-awned, six-rowed variety, with the purified white-grained, smooth-awned segregate which was used as a parent in the second series of crosses and of the other two parents of the new varieties which have been obtained, gives some idea of the degree of inherited differences in the varieties worked with. The data on infection to "spot blotch" are presented in Table I:

TABLE I—COMPARATIVE INFECTION OF SEVERAL VARIETIES OF BARLEY USED AS PARENTS

	Reaction to H. sativum			
Variety	1921	1922	1923	Average
Lion	9	7	20	12
Smooth Awn	15	11	20	15
Manchuria	16	26	30	24
Luth	16	30	28	25

It is apparent from this table that Lion is somewhat more susceptible than the Smooth Awn strain which was obtained from the cross of Lion and Manchuria and that the Manchuria and Luth strains used as parents are rather resistant. Both Manchuria and Luth were more severely infected in 1921 than Lion in 1923 which emphasizes the importance of environmental factors.

Coefficients of correlation were calculated for the reaction to *H. sativum* in two separate comparisons. It was possible to compare the infection of 49 strains for 1920 and 1921 and 67 in 1921 and 1922. The coefficients obtained were 0.497 ± 0.073 and 0.616 ± 0.051, respectively. This shows the extent of inheritance of the character under the conditions of the experiment. Seasonal variations in relation to period of maturity of the strains is one cause of variations.

That reaction to *H. sativum* is of importance was determined by correlat-

RESISTANCE TO "SPOT-BLOTCH" INFECTION

Figure 11

Differences in culm and leaf infection of two smooth-awned strains of the second series of crosses when sprayed with spore suspensions of *H. sativum.*

At left: Velvet, Minn, 447, a desirable resistant variety. At right: A variety which proved as susceptible as the smooth-awned segregate, which was used as one of the parents of this series of crosses.

ing the average yield for 1921 and 1922 of 39 smooth-awned strains in replicated rod row trials with the average infection in five-foot rows when the plants were infected by spraying and growing in diseased soil. The extent of correlation was 0.445 ± 0.087 which indicates that disease was of importance in the rod row tests even though these were carried on in fields which were under proper types of crop rotation.

The Mode of Inheritance of Smooth vs. Rough Awns and Reaction to *H. Sativum*

Rough awns are dominant to smooth and segregation in F_2 approaches a ratio of 3 rough to 1 smooth; however, there are different degrees of smoothness which are inherited and which are dependent upon modifying factors. In crosses between Lion and Manchuria there was an apparent linkage between smooth awns, black color and susceptibility to *H. sativum* although breaks in linkage were obtained. Lion and Manchuria were compared for two years with 124 F_3 lines selected at random. Of this number 6 were apparently homozygous for resistance while 8 were as susceptible as Lion[8]. It was apparent that at least two factors were involved. In a later study of a cross between Svanhals and Lion, Griffee[2] observed linkage between the characters black color, smooth awn and six-rowed with susceptibility. As black vs. white, smooth vs. rough, two-rowed vs. six-rowed appeared independently inherited, it was concluded that at least three factors or groups of factors were concerned in this cross in conditioning reaction to *H. sativum*.

From these brief reviews it is apparent that reaction to *H. sativum*, while greatly influenced by environment, is inherited in the same manner as other characters and that resistant types can be selected from crosses between susceptible and resistant sorts.

The Production of Improved Smooth-Awned Varieties

During the period that the genetic studies were being conducted, the better varieties were being isolated by yield trials and by studies of reaction to *H. sativum*. The difficulty of obtaining smooth-awned varieties, which were resistant, was overcome by growing several hundred lines under comparable conditions. The cost of such an experiment is not very great for large numbers can be compared in rod row trials without great expense. In these studies approximately 125 strains have been tested in rod rows (Figure 13). Many of these strains were more susceptible to attacks of *H. sativum* than Manchuria and others were undesirable from the agronomic standpoint. Several strains which performed most favorably in rod row trials have been grown in 1/40th acre trials at various localities in the state. These studies have been sufficiently extensive so that it appears probable that the new varieties are satisfactory. A comparison will be made between three such varieties and Manchuria, Minn. 184, a pure line selection which has consistently been a good performer in Minnesota and which in the past has been accepted as the standard six-rowed variety for the state. Comparative yields are given in Table II (Figure 14):

The results show that all three of the new varieties, Velvet, Glabron and Comfort, have yielded practically as well as Manchuria, Minn., 184. It may be noted that the smooth-awned sorts yielded more than Manchuria, Minn., 184, for the 5-year average in the rod row trials at University Farm and some doubt might then arise as to the comparative yields in rod rows and in 1/40th acre plots.

The data for 1/40th acre plots (see Figure 12) are given for only three years as Comfort has only been tested for this period. Glabron and Velvet have been grown in 1/40th acre plot trials for four years at University

EXPERIMENTAL PLOT OF VELVET

Figure 12

Velvet, one of the new smooth-awned hybrids in a 1/40th acre plot at University Farm. The two border rows are discarded before harvest. This variety was distributed to Minnesota farmers in 1926.

Figure 13

Rod row trial of smooth-awned barleys. Each strain was grown in 3-row plots and the central row of each harvested for the yield trials. Four systematically distributed plots were used for each variety.

Farm since they were grown in 1922 as well as for the period 1923 to 1925 inclusive. On the 4-year basis Velvet yielded an average of 2.9 bushels more than Manchuria while Glabron yielded 9.6 bushels more than Manchuria.

A comparison of manner of reaction to *H. sativum* is given in Table III. All three smooth-awned varieties appear about as resistant as Manchuria.

Of equal importance to yielding ability is ability to withstand lodging. In some years all varieties stand up well while this is true of only a few varieties in other seasons. Notes on lodging are taken on two bases, percentage lodged, i. e., the proportion of the plot with lodges, and degrees lodged, the angle which the lodged culm makes with the ground. Plants which are flat are considered as 100° lodged. It is unnecessary to present data for the years in which lodging did not occur. The data given in Tables IV and V represent percentage and degree of lodging, respectively, for those years in which lodging was a factor.

All three smooth-awned varieties are the equal of Manchuria, Minn. 184, in ability to withstand lodging while Glabron appears much superior to it in this regard. On the basis of these studies it appears that Glabron can be grown satisfactorily on comparatively heavy soils. For example, Glabron stood up well on the rich heavy soils at Waseca when Manchuria lodged badly. In the 1/40th acre plots Glabron has stood up sufficiently well so that in all cases it could have been harvested with the binder without difficulty.

Summary

1. The awn of barley is an important physiological organ, and for this reason awned varieties of barley yield better, on the average, than hood-

VELVET—A NEW SMOOTH-AWNED VARIETY

Figure 14

This variety was obtained from the cross of Smooth Awn × Luth. Representative spikes and grains.

ed barleys. The rough awn makes handling unpleasant and therefore desirable smooth-awned varieties would be of great economic value.

2. The first series of purified hybrids from crosses made by Dr. Harlan about 1912 failed in Minnesota because they were more susceptible to attacks of the spot blotch disease caused by *Helminthosporium sativum* than standard varieties such as Manchuria.

3. A second series of crosses was undertaken and the problem of resistance to *H. sativum* was attacked cooperatively by plant breeders and plant pathologists. Two or three main pairs or groups of genetic factors were involved and there was linkage between the factors for susceptibility *vs.* resistance with the factors for black *vs.* while grain color and smooth *vs.* rough awn. The linkage, however, was not absolute and cross-overs occurred so that it was possible to obtain smooth-awned, white-seeded varieties which were also resistant to *H. sativum.*

4. Three such smooth-awned varieties have been tested for several years in rod row trials and for three or more years in 1/40th acre plots at the branch stations, Crookston, Morris, Waseca and Grand Rapids, and at University Farm. These three varieties appear the equal of Manchuria in yielding ability, strength of straw and other agronomic characters, and are as resistant to attacks of *H. Sativum* as Manchuria.

5. The varieties have been named Velvet, Minn. 447; Comfort, Minn. 451; and Glabron, Minn. 445. Velvet was increased in 1925 at the experiment stations and several hundred bushels of seed have been planted by Minnesota farmers in 1926. No seed or Glabron and Comfort is yet available for commercial planting.

6. On the basis of the results of these experimental tests it appears that Glabron is more desirable from the standpoint of strength of straw than Manchuria, Minn. 184, the present recommended variety in Minnesota. It is adapted therefore for growing on rich lands where ordinary varieties of Manchuria lodge badly.

TABLE II—A COMPARISON OF YIELDS OF THREE NEW SMOOTH-AWNED VARIETIES OF BARLEY AND OF MANCHURIA. MINN. 184

	Average yields in bushels per acre					
	Rod rows (1921-25)	*1/40th acre plots* (1923-25)				
Variety	U.F.	U.F.	C.	M.	W.	G.R.
Manchuria, Minn. 184	48.6	35.7	36.4	40.5	59.3	24.1
Velvet (Smooth Awn × Luth), Minn. 447	52.8	33.3	33.8	39.6	60.0	20.9
Glabron (Smooth Awn × Manchuria), Minn. 445	53.0	42.3	37.4	41.8	59.8	29.4
Comfort (Smooth Awn × Luth), Minn. 451	56.1	35.9	39.4	39.5	58.6	25.4

In this table U. F.=University Farm, St. Paul C=Crookston; M=Morris; W=Waseca; and G. R. =Grand Rapids. Four systematically distributed plots were used in the rod row tests and three for the 1/40th acre plot trials. Data for the 1/40th acre tests were obtained from Prof. A. C. Arny who is in charge of varietal trials.

TABLE III—REACTION OF MANCHURIA, MINN. 184, AND OF THREE DESIRABLE SMOOTH-AWNED VARIETIES TO *H. SATIVUM* (1921-1925)

Variety	*Reaction to H. sativum* 1921	1922	1923	1924	1925	Average
Manchuria, Minn. 184	15	27	30	24	23	24
Velvet, Minn. 447	14	29	30	21	21	23
Glabron, Minn. 445	14	28	23	24	22	22
Comfort, Minn. 451	18	27	30	21	24	24

TABLE IV—PERCENTAGE LODGING FOR THOSE YEARS AND LOCALITIES WHEN LODGING WAS MOST SEVERE

Variety	*Percentage lodging* *Rod rows* U. Farm 1921	1923	1925	*1/40th acre plot trials* U. Farm 1925	Morris 1924	Waseca 1924	1925	Average
Manchuria, Minn. 184	100	17	100	38	57	97	28	62
Velvet, Minn. 447	100	24	100	37	17	15	42	48
Glabron, Minn. 445	100	0	23	7	15	0	10	22
Comfort, Minn. 451	100	0	100	43	40	35	55	53

TABLE V—DEGREE LODGING FOR THE YEARS AND LOCALITIES WHEN LODGING WAS MOST SEVERE

Variety	*Degree lodging* *Rod rows* U. Farm 1921	1923	1925	*1/40th acre plot trials* U. Farm 1925	Morris 1924	Waseca 1924	1925	Average
Manchuria, Minn. 184	26	5	74	62	50	67	55	48
Velvet, Minn. 447	31	13	89	56	35	50	28	43
Glabron, Minn. 445	14	0	50	43	25	0	30	23
Comfort, Minn. 451	40	0	56	53	40	27	40	37

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The Races of Man

THE RACES OF MAN AND THEIR DISTRIBUTION, *by* A. C. HADDON, Sc. D., F. R. S. Reader in Ethnology in the University of Cambridge, New York. The Macmillan Co., 1925, pp. 201. pl.X. $2.50.

This book provides a welcome relief from the recent discussions of race which have been offered to the general reader. It is a careful objective description of the varieties of the human species, classified according to a new scheme proposed by the author. The racial criteria adopted are applied in a condensed but detailed description of the probable racial history of the chief geographic and political divisions of the world.

The racial classification used is modern in that it is based entirely on physical traits such as hair form, head shape and skin color, and depends not on single traits but on combinations of these. The chief taxonomic character used is hair form. The division of the races of man into the yellow, the black and the white to which the layman is accustomed recedes in favor of the straight, the smooth and the woolly haired, as in some of the older classifications. Considerable use is still made of head form (the cephalic index), the reliability of which as a racial character has become more and more questionable.

The racial descriptions which represent only slight expansions of the bare classification are necessarily short and arbitrary, including no detailed data, since the author has chosen to make brief mention of many minor groups rather than to characterize carefully the major subdivisions. This makes the book valuable for reference (the index is excellent; under "A" may be counted some sixty names of races, tribes or other groups) but the inclusion of so many facts in so condensed a form makes of many of its pages mere lists or catalogues. The author has been chiefly concerned with presenting his scheme in as terse a form as possible. The work is in fact but the bare bones, the program, for a larger work on which the author is engaged.

The reviewer was impressed with the value of the purely descriptive part of the book. He was less satisfied with the final quarter, in which the author gives his tentative conclusions in respect to the evolution and dispersal of racial groups and his opinions on heredity and environment as race forming forces. This part is offered chiefly for the criticism of anthropologists, and while it contains interesting suggestions on the dispersal of races, is rather disconnected and incomplete. This is apparently a consequence of the author's realization of the limitations of the data available. The chief value of any taxonomic study even when applied to man inheres after all in the accuracy and completeness of its descriptive facts. In the present stage of racial studies the importance of such facts far exceeds that of attempts at synthesis, and Dr. Haddon's book demonstrates the truth of both of these statements.

L. C. D.

An Elementary Handbook of Evolution

EVOLUTION, HEREDITY AND VARIATION, *by* D. WARD CUTTER, chief protozoölogist to the Rothamsted Experimental Station. Pp. 143, with 27 illus., price 4 shillings net. London, Christophers, 1925.

An admirable introduction to the subject, simple and clear, concise and comprehensive. It is nearly free from errors, and manages to give a fair picture of every important phase of evolution. The chapter on biometry is perhaps the least adequate. On the whole, a book to recommend cordially.

P. P.

INHERITANCE IN FOUR O'CLOCKS

FRANCIS P. KIERNAN and ORLAND E. WHITE
Brooklyn Botanic Garden

THE more commonly grown varieties of the four o'clock or marvel of Peru, (*Mirabilis Jalapa*) have crimson, yellow, or white flowers. Correns and later Marryat carried on hybridization studies on these flower color types in the early years of the development of genetics as a science. Below is given a brief review of their work on these colors. Following this are detailed the experimental results secured by the senior author on these same color races, together with those from an additional flower color race breeding true to rose or "shell pink" flowers.

When any one of the three flower color races mentioned above—crimson (red), yellow, white—is self-pollinated, it will breed true, because heterozygotes resulting from chance cross-pollination can be distinguished. Crimson × yellow gives in F_1 only plants with orange red flowers. These F_1 plants, when self-pollinated, give F_2 progeny in a ratio approximating 1 crimson; 2 orange red; 1 yellow. Both crimson and yellow in F_3 breed true, the orange red plants again producing the F_2 ratio. Crimson × white in F_1 gives plants only with magenta (red) flowers, which in turn when self-pollinated, give F_2 plants approximating a ratio of 1 crimson: 2 magenta: 1 white. Marryat found in her experiments that two genetically distinct white flowered types existed, one (the most common) which carried the ability to produce red flowers when crossed with a yellow. The other white, though outwardly indistinguishable, did not have this ability. The latter white when crossed with yellow gave F_1 plants with pale yellow flowers. When these were self-pollinated the F_2 generation grown consisted of three color types, approximating a ratio of 1 yellow: 2 pale yellow: 1 white. Marryat's actual results were 19:34:18—expected 17.75:35.5:17.75.

In all these crosses, the difference between the varieties crossed is monofactorial and the F_1 hybrid or heterozygote is easily distinguished, the flower colors being in a sense, a blend or intermediate between those of the parents.

Correns and Marryat found that yellow crossed by white, other than the white just discussed, gave a magenta rose flowered F_1 generation, instead of a pale yellow. When this magenta rose was self-pollinated, an F_2 generation, approximating a ratio of 1 crimson: 2 magenta: 2 orange red: 4 magenta rose: 1 yellow: 2 pale yellow: 4 white, was obtained. The actual F_2 generation as grown by Marryat consisted of 447 individuals.*

As interpreted by Correns and later by Marryat, this great range of color classes is brought about by only two pairs of genetic factors. These are *Y*, a factor for yellow color and its allelomorph *y*; *R*, a factor which changes yellow to red and its allelomorph *r*. Hence the flower color classes listed above represented in factorial terms would be crimson (*YYRR*), magenta (*YyRR*), orange red (*YYRr*), yellow (*YYrr*), pale yellow (*Yyrr*), white (*yyRR* and *yyrr*). The F_3 generations from these various types confirmed the theoretical expectations. The crimson, yellow and white segregates bred true; the orange red, magenta and pale yellow gave 1:2:1 ratios and the magenta rose segregates repeated again the F_2 dihybrid ratio of 1:2:2:4:1:2:4. There were some complications involved in this cross in connection with the striping or flaking in flower color, but these need not be discussed here.

As a matter of historic interest, it should be mentioned that it was in con-

*Obtained ..... 45 crimson, 57 magenta, 65 orange red, 101 magenta rose, 27 yellow, 56 pale yellow, 96 white.
Expected (448) ..... 28 crimson, 56 magenta, 56 orange red, 112 magenta rose, 28 yellow, 56 pale yellow, 112 white.

nection with his investigations on four o'clocks that Correns[1] first suggested the concept that later developed into the presence and absence hypothesis, which for so many years proved a useful genetic tool.

In 1921, the senior author repeated some of the earlier work, obtaining similar results. Three sets of crosses were made. These were crimson × white, crimson × yellow, and yellow × white, giving in F_1 respectively magenta, orange red, and magenta rose progeny. Thirty-eight F_2 plants were raised from the magenta (the F_1 of crimson × white) and these were distributed among 8 crimson : 22 magenta : 8 white—expected on a 1 : 2 : 1 basis—9.5 : 19 : 9.5. From the orange red F_1 of the crimson × yellow cross, 28 F_2 plants were grown. These were classified as 6 crimson : 14 orange red : 8 yellow—expected on a 1 : 2 : 1 basis—7 : 14 : 7. The magenta rose of the third cross made, matured too late to produce viable seed.

Among the four o'clocks grown from year to year in the systematic collections of the Brooklyn Botanic Garden, is a type or race with flowers of a clear shell pink (or rose pink of Ridgway[6]), which the horticulturist of the Garden says is not new as he has known it for many years. It is a color, however, in our experience, that is not commonly grown, and some of the old works on English gardening, such as Miller's Dictionary, do not mention it. In the literature of modern genetics, so far as we can discover, no mention is made of this pink flowered type being used in crosses with the color types previously mentioned. The pink generally referred in numerous textbooks on genetics and botany (see Castle, Morgan, Sinnott and Dunn, and others) as a heterozygote or intermediate form between red and white in connection with the experiments of Correns[1,2,4], probably is not pink at all, but magenta. At least Correns refers[2] (p. 70) to the flower color of the F_1 hybrid of white (*alba*) × yellow (*gilva*) as "hell rosa." In both Marryat's and our own experience, this flower color is always magenta rose, and not bright pink. In an earlier paper[1] (p. 597), varieties or forms are listed and *M. jalapa* (typ.) *rosea* is described as having "rosa" flowers.

Either Correns uses "rosa" to include both pink and magenta flower colors or his "rosa" is the magenta of Marryat and the senior author's cultures. His alba × rosea cross would then be the cross of the common white (*yyRR*) × crimson (*YYRR*) described above, which in F_2 gives a 1 : 2 : 1 ratio. Wheldale[7] while discussing the literature and color ranges in Mirabilis does not refer to pink flowered types, but apparently regards Correns's rosea as crimson. The pink flowered form we have breeds true when selfed.

Three crosses with this pink-flowered form were made. The first cross was crimson × pink, giving an F_1 generation with dilute crimson flowers (the rhodamine purple of Ridgway.[6]) From this F_1, 12 F_2 plants were grown. These were classified at the time rather crudely as 2 deep crimson (rose red fading to pomegranate red of Ridgway), 5 dilute crimson as in F_1, and 5 rose pinks. On the interpretation set forth below, this classification is obviously too indiscriminate. The second cross—white × pink—gave an intermediate or very pale pink F_1, which produced 31 F_2 plants. Of these, 8 were white, 19 pale pink and 4 rose pink, the theoretical expectation on 1 : 2 : 1 basis for 31 plants being 7.75 : 15.50 : 7.75.

The third cross proved of most interest. Yellow × pink gave an F_1 with rose red flowers (rose red petal tips, light rhodamine purple throat fading to rose color of Ridgway) instead of a blend of the two parental colors as one might expect. This F_1 "rose red" can be distinguished easily from the magenta rose F_1 of the yellow × white cross of Correns, the latter being a deeper, more brilliant red. An F_1 plant of this latter type

grew in the same plot, so that both flower types could be compared.

When selfed, this F_1 produced 72 seeds all of which were planted in a seed pan. But the space available for growing them when they were to be transplanted out-of-doors would unfortunately accommodate only 51, so only the most robust seedlings were selected. Hence the plot of 51 F_2 plants represented a somewhat selected lot, as the colored flower types other than the pinks, are generally the most robust. Perhaps this circumstance has somewhat distorted the ratio that theoretically should have been obtained.

The F_2 results are given below:

The reds were of four distinct shades, namely, deep crimson (rose red changing to pomegranate red), rhodamine (purplish) red, scarlet red, and rose red with a rhodamine overcast of the F_1 type. The yellows were pale yellow and the deeper yellow of the original yellow grandparent. The pinks were of two shades, a light pink scarcely to be distinguished from white and the darker rose or shell pink of the pink grandparent. Thus from the interaction of two pairs of color factors, nine distinct flower color types are produced in the F_2 generation of yellow $\times$ pink, giving as striking a demonstration of a Mendelian hybrid segregation as one could well wish.

Two other types of crosses were made. Two crosses of orange red ($YYRr$) $\times$ pink (this orange red is the F_1 type of crimson $\times$ yellow) gave two F_1 plants, both red-flowered, but the reds were very different. In appearance one of these reds was similar to the dilute crimson of the F_1 of crimson $\times$ pink and presumably of the same genetic constitution (YyR^pR). The other red was rose red, such as would result in F_1 from yellow $\times$ pink (YyR^pr).

Two back-crosses of the F_1 hybrid of white $\times$ pink (pale pink) on white were made. Of the two plants obtained, one had white flowers, while the other plant had the pale rose pink flowers of the F_1 hybrid parent.

The results obtained from crossing the various flower color types with the rose pink flowered type indicate that the pink strain must carry a factor for pink, comparable to the R factor carried by the ordinary white-flowered strains. In the presence of the factor Y, this produces various types of red. By itself in homozygous condition it expresses itself as rose pink. When crossed with the ordinary white $yyRR$, it gave a pale pink F_1 heterozygote which in turn in F_2 produced a 1 rose pink: 2 pale pink: 1 white ratio. When the pink is crossed with the yellow flowered form, an F_2 series paralleling the yellow-white cross is obtained, but the colors are somewhat different. The F_1 flower colors of these two crosses are also different but not strikingly so; though that involving the pink is less brilliant. Such results as have so far been obtained are most logically explained by assuming that the R factor of the common white-flowered types has changed or mutated so as to pro-

TABLE 1—F_2 CLASSES OF YELLOW ($YYrr$) x ROSE PINK (yyR^pR^p)

Flower color	Deep Crimson	Rhodamine Purple	Scarlet Red	Rose Red	Yellow	Light Yellow	Rose Pink	Light Pink	White
Genotypic Constitution	YYR^pR^p	YyR^pR^p	YYR^pr	YyR^pr	$YYrr$	$Yyrr$	yyR^pR^p	yyR^pr	$yyrr$
Observed in 51	3	11	6	9	2	11	5	3	1
Expected in 51	3.18	6.36	6.36	12.72	3.18	6.18	3.18	6.36	3.18

duce pink flower color. In other words, pink is a multiple allelomorph of the *R* factor in the white flowered races, and hence should be designated R^p. Thus the pink variety has the formula yyR^pR^p.

The flower color determinations in the yellow-pink cross and in part in several other crosses were made by comparison with the colors in Ridgway's Color Standards and Nomenclature.[6] In other cases Marryat's names are used. By comparing the flower colors of the color plate in Marryat's paper with the Ridgway colors, magenta was determined as magenta, orange red as dragon's blood red, magenta rose as rocellin purple.* The orange red from crimson × yellow is a brighter, richer red than the scarlet red from the pink-yellow cross. Even with a standard color chart, these colors are difficult in some cases to name, as the age of the flower, temperature conditions, changing light, etc., produce complications. But when they are all growing side by side, and one sees them throughout a summer, all the various genotypes are easily differentiated.

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*In our experience, this F_1 has less purple in its flowers than the pink × yellow F_1 hybrid, hence magenta rose or rocellin purple is not its true color, but unfortunately we did not determine its true color by comparing its flowers with the colors of the manual.

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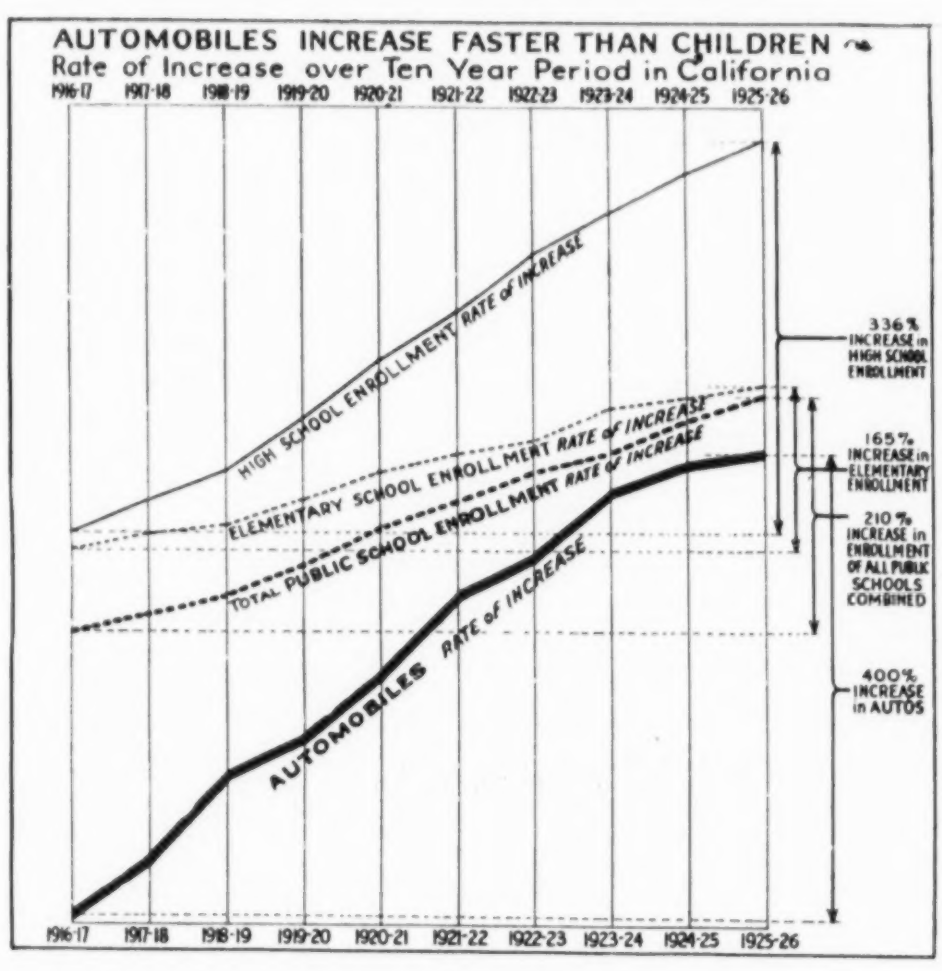
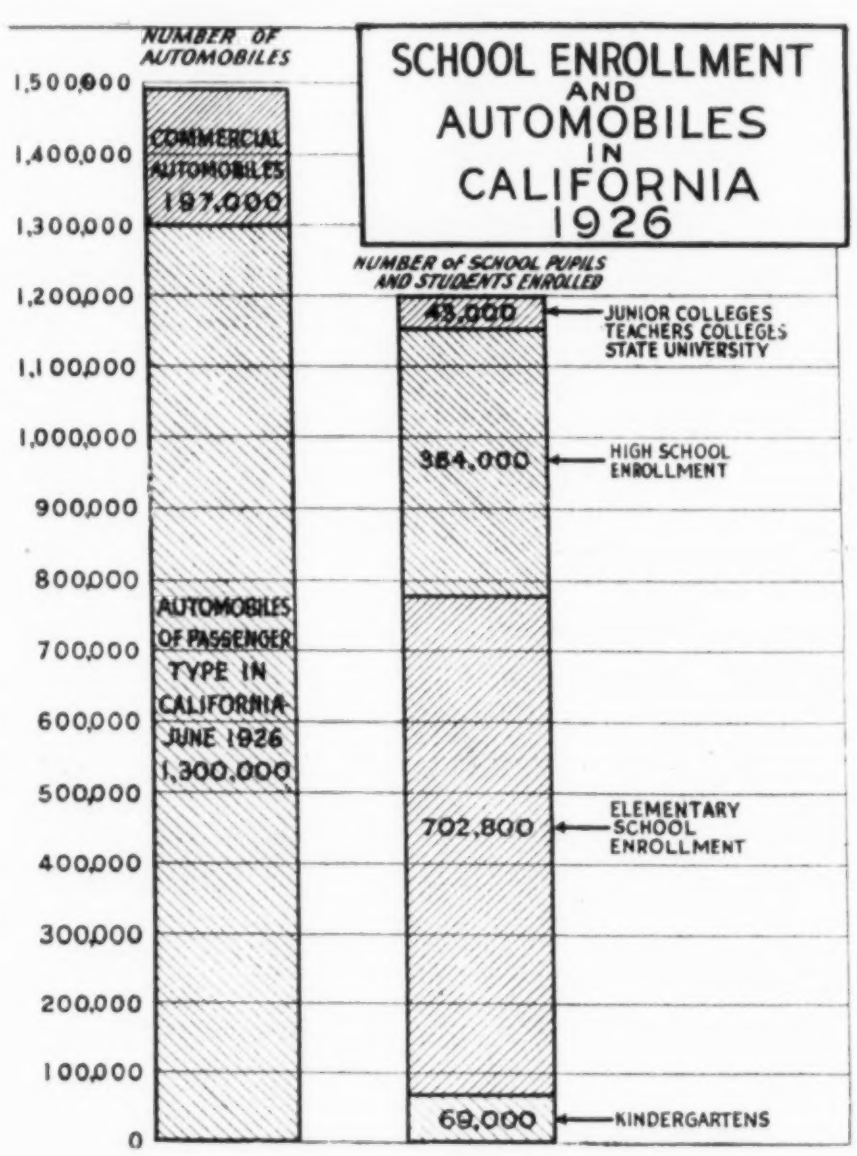
NEWS AND NOTES

Children and Automobiles

Statistics on Their Rate of Increase


AUTOMOBILES INCREASE FASTER THAN CHILDREN
Rate of Increase over Ten Year Period in California
1916-17 1917-18 1918-19 1919-20 1920-21 1921-22 1922-23 1923-24 1924-25 1925-26
HIGH SCHOOL ENROLLMENT RATE of INCREASE
ELEMENTARY SCHOOL ENROLLMENT RATE of INCREASE
TOTAL PUBLIC SCHOOL ENROLLMENT RATE of INCREASE
AUTOMOBILES RATE of INCREASE
336% INCREASE in HIGH SCHOOL ENROLLMENT
165% INCREASE in ELEMENTARY ENROLLMENT
210% INCREASE in ENROLLMENT of ALL PUBLIC SCHOOLS COMBINED
400% INCREASE in AUTOS
1916-17 1917-18 1918-19 1919-20 1920-21 1921-22 1922-23 1923-24 1924-25 1925-26



THERE are more automobiles of the passenger type, in California today than there are pupils or students in all of our kindergartens, elementary schools, high schools, junior colleges, teachers colleges, and the state university combined.

Every boy, girl, man and woman who attends a public school in this state, from the kindergarten to and including the state university, could ride to school in a California owned automobile and ride alone! And then there would be enough cars left over to care for all members of all the faculties,—and fifty thousand to spare.

Aside from the capital outlay represented by the automobiles owned in the state there is a large automobile expenditure in the form of gasoline, oils, tires, and other automobile accessories. In 1925, 807,519,350 gallons of gasoline were sold in California. If it is assumed that the average cost per gallon is eighteen cents, then the cost of gasoline during that one year was $145,353,483.

The total expenditure for 1923-24 for all kinds of public education, from the kindergarten through the state university, including capital outlay as well as running expenses, was $130,737,912. This includes state, county, city and district school expenditures. If the capital outlay, cost of oils, tires, repairs, and the thousands of other automobile expenditures are added to the cost of automobiles, the cost of education becomes insignificant in comparison.

GEORGE C. JENSEN in
Sierra Educational News.

IN what parts of Florida are the people most addicted to joy-riding? This question is easily answered when the gasoline consumption of each coun-

ty is divided by the number of inhabitants, as an accurate record is kept of all gasoline sold on account of the state tax, and nearly all of it is used in automobiles.

The gasoline consumption for the whole state in June, 1926, was 17.6 gallons per capita on the basis of the census figures, but probably only about 15 gallons, when the increase of population is taken into account.

Sarasota and Broward counties lead the state with a gas consumption in June of about 43 gallons per capita on a basis of 1925 population; but if those counties have doubled in population since the census, as some of their boosters believe, the true figures would be nearer 20 gallons. But even that would be enough to transport every family several hundred miles in a month or several thousand miles in a year.

Next in order are St. Lucie, Palm Beach, Charlotte, Hendry, Dade, Highlands, Martin, Brevard, Okeechobee, Lee Indian River, Orange, Lake, and Flagler, all of which are above the state average in the use of gasoline per capita. Nearly all of these are rapidly growing counties in the southern part of the state, with a considerable urban population.

The following counties, arranged in alphabetical order, used less than half as many gallons of gasoline per capita in June as the average for the state: Baker, Calhoun, Clay, Collier, Dixie, Gadsden, Gilchrist, Gulf, Holmes, Jackson Jefferson, Lafayette, Liberty, Madison, Monroe, Nassau, Okaloosa, Santa Rosa, Suwanne, Taylor, Union, Wakulla, Walton and Washington. Most of these counties are in the northern part, and have a large farm population. The low gasoline consumption in some of these is probably due to the large negro population.

The most significant thing about the counties which use the least gasoline is that all, or nearly all, have larger families than the state average. Prof. Harper, who male this study, estimates that in the course of a year it costs just about as much to operate an automobile as it does to feed a child, so that where automobiles are most numerous, children are apt to be in the minority.

—*Florida Associated Press Dispatch*—Corrected by R. M. Harper.

The 1926 Endurance Rides

THE annual endurance rides, which have recently been completed, finish an interesting comparison with those which were established by the Pony Express. The modern rides are of a very different character. The loads carried are much heavier, and rides are not life and death affairs. At the end of the ride the horses are judged on their ability to travel the next day —and the day after. They are not driven to the limit of their endurance as was certainly the case in some of the amazing records made by the Pony riders.

"Tomahawk," a half-bred army horse from Ft. D. A. Russell, Cheyenne, Wyoming, was the winner in the 1926 Colorado Endurance Ride, held at Colorado Springs, September 12-17. He completed the prescribed 300 miles in 45 hours 36 minutes, and was awarded a perfect score for condition when the final judging was completed; his total score was 55.2 points. "Tomahawk" is said to be of a half Morgan and half Standard bred mare.

Second place was won by "Stella," an army entry from Ft. Meade, S. Dak., with a total of 92 points. Third place was won by "Vamp" owned by Capt. H. N. Beeman, Ft. Riley, Kansas, with a score of 88.2 points. Fourth place was awarded to "Prince" owned and ridden by Frank Girard, Cripple Creek, Colorado, with a score of 75.07 points.

The Colorado ride was noteworthy

in that 87 per cent of the horses that started crosed the finish line, this being the first time in the history of these rides that such a large percentage have completed this arduous test. This performance was all the more remarkable as the weight imposed this year was increased from 200 lbs., the weight prevailing in 1925, to 225 lbs.

Mr. Richard S. Waring of St. Angelo, Texas, and New York; Charles D. Cary, Cheyenne, Wyoming, and John O. Williams, Washington, D. C., were the judges of the Ride.

The Annual Eastern Endurance Ride for 1926 was held at Brandon, Vermont, on October 11-15. The winner was the half-bred mare "Miss Brandon" entered by the Service Troup, 3rd Cavalry, Ft. Myer, Va. Fourteen horses started and six finished—only 43 per cent—just half the percentage finishing in the Western Ride. As in the Colorado ride, the weight carried this year was 225 pounds.

"Stockings," also entered by the 3rd U. S. Cavalry, was second. "Rex Rysdyk," a saddle-bred horse, entered and ridden by Mr. R. T. M. McCready, Pittsburgh, Pa., was third. "Peggy," the winner of the 1924 and 1925 rides, and entered by the 3rd U. S. Cavalry, was fourth. "Lillian Russell," entered and ridden by Capt. J. A. Weeks, was fifth. "Bunny Boy," entered by the 3rd U. S. Cavalry, was 6th.

Mr. Allen Case, Toronto, Ontario, Canada; Dr. W. W. Townsend, Burlington, Vermont, and Judge Sears, Newberg, New York, were the judges.

Peach Hybrids again Resist Defoliation Disease

IN connection with the delayed foliation of peaches and other diciduous fruits in southern California and the possibility of circumventing this trouble by the use of new varieties and hybrids, as reported in the March number of this Journal, there have been some interesting recent developments. The present season has seen a repetition of the conditions reported for 1924 and many commercial peach orchards have been even more severely affected than they were that year. At the same time the Peento hybrids at Riverside and Ontario are in normal condition and bear heavy crops of fruit.

On July 14th a conference of peach growers, canners, and experiment station and extension workers was held at Riverside, those appearing on the program being Director H. J. Webber, W. H. Chandler, Geo. P. Weldon and H. B. Frost. Following the program the Peento hybrids were inspected. All seemed to be astonished and much pleased with the generally good appearance and heavy bearing qualities of these hybrids, and in some instances with the quality of the fruit. The conference adopted several resolutions of which the following is one:

Resolved, That this conference of peach growers and canners express their great interest in the hybridization experiments that have been conducted by the University of California and urge upon the proper authorities the continuance of the work. We believe the State is justified in more liberally supporting a project of this nature.

Limits of Statistical Methods

YOU asked me to speak of the statistical methods of treating data. I wish you had not. It is a mean subject. Those of you who have read the biography of the great Lord Rayleigh by his son will recall his statement that he does not believe in statistical methods, that the object of repeating an experiment is to judge of the control acquired, that he even doubts the utility of averaging values to obtain a mean, though he admits that this is carrying disbelief rather far. We find very little statistical analysis in ex-

perimental physics or chemistry today, a smaller relative amount, I think, than was found a generation ago; and even in astronomy, for which the method of least squares was developed by Gauss and in which it was universally applied in the past, there is a strong tendency to short-cut formal statistical processes. It is now to the biologist or economist that you must go for complicated statistical analysis. Why this state of affairs? May it perhaps lie in a contrast of the experimental and observational methods in a difference of degree of attainable control? Shall we say that when the control is good, when we are working in a field in which control is easy or when we are sufficiently astute or fortunate to design experiments so that those consequences in which we are interested are independent of the other variations, then we have no need of statistics and can go along with Lord Rayleigh? Shall we admit that statistics belongs rather in the field of observation and serves to replace control when that is not attainable or is repugnant to the nature of the investigator?

We must think here not so much of statistics as a method of description, but more of it as a basis for induction. If we believe that induction requires rationalism in experimental procedures which are relatively exact, we must feel that it requires an even higher degree of insight and thoughtfulness. of care and of diffidence when maneuvering in crude and complicated realms. It pays to begin the analysis with simple methods, to make diagrams to rearrange the data and make new pictures, to dwell with the material until one knows its excellencies and its defects in respect to those particular items that may be important for the conclusions, to take into account not alone the data themselves but any general scientific considerations that may be germane to the induction. This attitude any one may cultivate; it is consonant with the admonitions of Bowley and of Westergaard to eschew elaborate processes which carry one out of touch with the original figures and which by their very elaboration give a false sense of security. Except by accident, mathematical conclusions are no sounder than the premises that went into the formulation of the problem, and they may be much weaker because of those accessory assumptions which are so apt tacitly to creep in during the progress of the work.

(Wilson, Edwin B., Empiricism and Rationalism, *Science*, Vol. LXIV., No. 1646, July, 1926, pp. 52 to 54.)

Double Opening of Avocado Flowers

MIXED plantings of avocado varieties are more conducive to complete fruit setting than are solid plantings of one variety, concludes the United States Department of Agriculture after a study of the flowering habits of this unique subtropical fruit. According to Department Circular 387-C, just issued, the avocado has two sets of flowers, which under normal conditions have definite periods of opening and closing.

In some varieties, the first-period flowers (receptive) open in the morning, with second-period or pollen-shedding flowers opening in the afternoon. In the other varieties the order is reversed, the morning flowers shedding pollen and the afternoon flowers being the receptive ones. Since the receptive flowers are closed in each case when the pollen shedding flowers are open, pollination within a variety does not take place except under abnormal weather conditions. However, it is possible, says the department, to secure cross-pollination by planting varieties of the two groups together.

Little is yet known as to the best varieties to plant together; but solid plantings of a single variety or of varieties all of one class are decidedly unwise, in the light of the data presented in the circular.